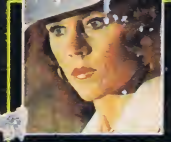

Jane Fonda:
Filming Nuclear Disasters

H.G. Wells:
The New Things To Come

FUTURE LIFE

UK
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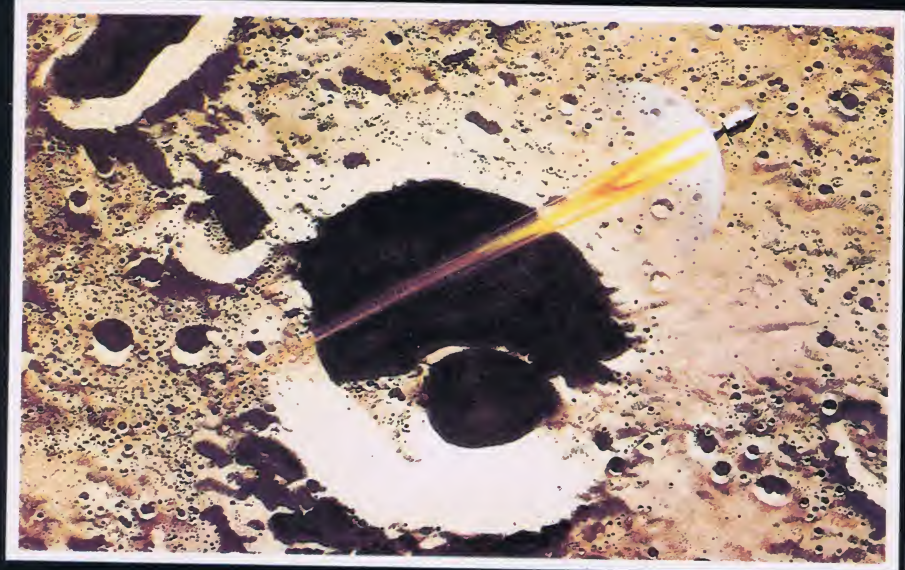
MAY 1979 #10

HOW TO BUILD A SPACE COLONY

By GERARD K. O'NEILL

Timothy Leary On Evolution • Nova's Scientific Sleuths
Roger Zelazny: Future Crime • Todd Rundgren's Videomusic
The Spectre of Space War • Life In The 23rd Century
Design Your Getaway Special • Jack the Ripper: Time Traveler

SPECIAL!
LIMITED QUANTITY AVAILABLE!
Robert McCall's Classics Now Available Individually



"Apollo VIII Coming Home" (NASA Collection)

"First Men On The Moon" (Private Collection)

"Space Station One" A 24 × 28 inch lithograph

In the future Man will use his down-to-earth technology to reach deep into the awesome infinity of outer space. Robert McCall has already been there. He has a mind that spans time and space, an eye for technical detail and the hand of a great painter. His spectacular Space Station One, created for the film "2001: A Space Odyssey," has become a collector's item and a contemporary classic.

Frequently commissioned by NASA to do on-the-spot paintings of America's ventures into space, McCall is always present for important launches and splashdowns. His oil paintings have gained international acclaim reproduced as U.S. Postage Stamps, one of which was the first stamp cancelled on the Moon, and another, his most recent, commemorated the historic Apollo-Soyuz space rendezvous. McCall's work hangs in important museums, corporate offices and private collections around the world, and he has been honored in a one-man space art show at the Smithsonian Institution.

There is no question about it, Bob McCall is the premier space artist of this generation. Now offered are three gallery-quality lithographs of McCall's work. These are incredibly detailed, beautifully colored paintings of Man's greatest journeys. Each 24 x 28 inch lithograph is accompanied by a descriptive statement in the artist's own words. Each lithograph can be acquired for $10. This limited collector's edition has been authorized by the artist and FUTURE LIFE Magazine guarantees your complete satisfaction.

Mail To: FUTURE LIFE MAGAZINE
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Please send me without delay the following Bob McCall lithographs:

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FUTURE LIFE

MAY 1979, #10

ART: SYD MEAD (SEE PORTFOLIO BEGINNING PAGE 58)

FEATURES

DEPARTMENTS

FUTURE LIFE
MAY 1979 #10

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For Advertising Information: Ira Friedman, Rita Eisenstein (212) 689-2830.

ON THE COVER: A torus space colony painted by Don Davis. Building the first colonies is no puzzle to Princeton's Gerard K. O'Neill—see story page 42.
ON THE CONTENTS PAGE: A detail of a painting by Syd Mead, depicting the interior of a spacious outer space habitat designed as a vacation world. See Syd Mead Portfolio, page 58.

output

My apartment in Manhattan is built out into the East River on a man-made concrete shelf. At the base of the building is a marina, filled (in warm months) with gleaming white luxury yachts, and at the far end of the dock is a loading platform for small sea planes — busy almost year-round shuttling New Yorkers to nearby islands and vacation spots. About two blocks north of my building is a busy heliport — offering tourists breathtaking spins over the world's greatest city and delivering celebrities and dignitaries from the heart of Manhattan to numerous airports within minutes.

From my windows I can see elevated highways, bridges, subway trains (crossing the river), ships, tug boats, barges, and jets landing and taking off in all directions. Frequently I look out at all this miraculous transportation, and I have to remind myself that this is *not* the world of the future — this is today.

Of course twenty years ago this sort of city atmosphere did not exist. It *was* the future then, and we went to see movies, and read books and magazines in order to "see" what the city of the future would be like.

We do the same thing today. In this magazine, for instance, we think ahead and visualize what everyday life will be like twenty or so years from now. It's an exciting mental activity: looking backward and forward. One look tells us how far we've come, and the other look tells us how far we can go.

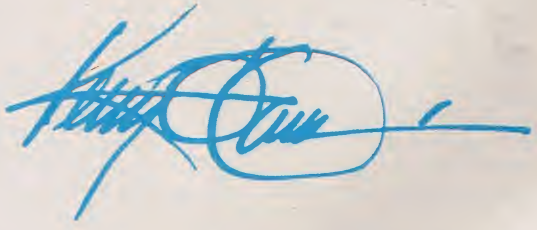
This same kind of *looking* is the basic format of one of television's most fascinating series, *Nova*. In this issue we have gone behind the scenes in order to give our readers an in-depth view of how the show is produced — how ideas are brainstormed, how data is gathered, and how research is turned into audio-visual presentations that contain as much *entertainment* as any dramatic series.

Nova not only presents theories and possibilities for *future* solutions to problems but also shows progress *today* that few people know about — research that is well underway and technology that is in use, but not widespread. *Nova* looks all the way to the edge of the horizon, and the staff of FUTURE LIFE feels an obvious kinship of purpose with this extraordinary show.

One of our editorial premises is that the more we learn about what exists today, the greater our ability to look into tomorrow. While our attention is most often aimed toward the horizon, and beyond, we ought to pause now and then to explore, and savor, our immediate surroundings.

Look up and see helicopters and supersonic transports sailing past the spires of soaring skyscrapers. Look around and see appliances and gadgets that embody designs and electronics far beyond movie and TV props used just ten years ago to indicate the future. Look everywhere and observe the "miracles" of science and industry that are so common that we take them completely for granted.

Tune in to the world of the present and enjoy the fact that we are actually living in the world of the future.



Kerry O'Quinn/Publisher

input

VARIOUS EGOS AND BIGOTS

. . . Mr. Ellison's response to Ronald Waite's and Michael Villa's letters in issue #8 is typical of that of most liberal extremists in this country. Being in the minority opinion, supporters of unpopular causes are naturally sensitive and thus prone to vicious and sometimes careless remarks in their defense. Although I do not profess to speak in their place, I think that I can safely interpret Waite's and Villa's remarks. I believe Waite's statement is representative of that many Americans in that they are frustrated (and rightly so) at the myriad causes to which liberals of every stripe attach themselves. This is not to say that they are against such basic things as civil rights, but rather the bogging down of the system by selfish groups that have no argument but need something to occupy their time. As the news editor of my college paper, I've run into similar circumstances regarding oversensitive special interest groups and thus feel qualified to respond to Mr. Ellison's imbecilic letter. Though a person as opinionated as Mr. Ellison deserves an answer to his missive in kind, I don't believe in trading useless insults with him (notice the restraint). But for one fond of citing legal documents, Mr. Ellison is quick to silence all without an "informed opinion." Just who is going to point out what is informed and what is not, Mr. Ellison, people as obviously biased as yourself? You must find life behind the Iron Curtain a paradise of "informed opinion."

Pierre Comtois
Lowell, MA

. . . My *informed* if not *slap-happy* and *buffoon* inspired opinion of Harlan Ellison's lengthy letter would be unprintable. Suffice it to say that he talks (or writes) too much. In a field where literacy and clarity of thought counts as highly as SF, he would do well to shut up.

Norman E. Morrison
Oxford, AL

. . . In reply to Harlan Ellison's letter in FUTURE #8: BRAVO.

Mike Hardy
Pensacola, FL.

. . . Harlan Ellison speaks truth and no one likes to hear it. Mr. Ellison is a big mouth, an elitist and has often changed his mind on his favorite issues. (Ie: he lambasted the SFWA a year or so ago for not recognizing television as a viable medium to portray SF and for totally ignoring it. He has now given up on TV altogether, which was a very smart move. His former stand smacked of naivete which is shocking for Harlan Ellison to say the least!) And I can only thank God (or whatever) for those qualities. The letters that are pouring in reflect on the writers and not Mr. Ellison.

Sandra H. Necchi
Temple University
Philadelphia, PA

SORRY, ARTHUR

. . . I appreciate the publicity on page 12 of the February FUTURE, but it does contain a rather large number of errors per square inch . . .

The Shining Ones wasn't a book, but a short story (now reprinted in *The Wind from the Sun*). And it was written *many* years after my initial (non-fiction) book on Ceylon, *The Reefs of Taprobane*. Harcourt, Brace, Jovanovich will be most annoyed to know that *The Fountains of Paradise* is being published by Random House! The paperback will be from Ballantine, sometime in 1980.

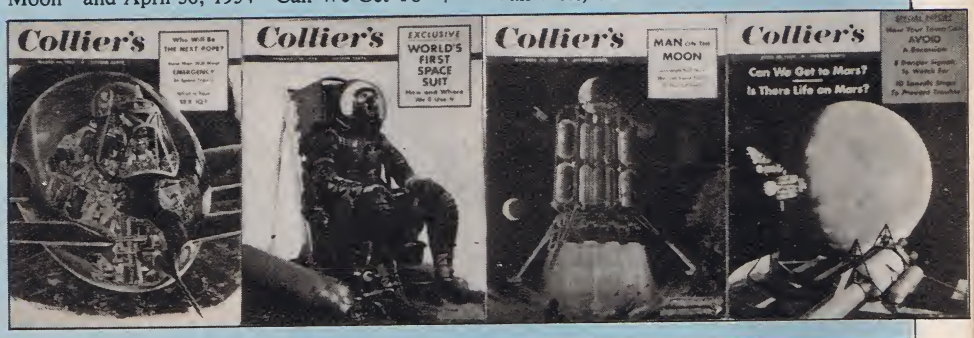
You might like to know that I've recorded highlights of the novel (and *Childhood's End*) for Caedmon. John Schoenherr has done a beautiful cover for the record and the program notes have been written by my good friends Isaac Asimov and Buckminster Fuller.

Arthur C. Clarke
Sri Lanka

COLLIER'S SERIES

. . . Here are four more Collier's covers depicting their space travel series. The two Bonestell paintings are from Oct. 18, 1952 "Man on the Moon" and April 30, 1954 "Can We Get To Mars — Is There Life on Mars." The other two are from March 14, 1953's cover by Fred Freeman (who did most of the cutaway illustrations in the series), and Feb. 28, 1953 "World's First Space Suit."

Mike Scott
Van West, OH



SCHALLER FAN

. . . In FUTURE #8 I was very impressed with the artwork of Adolf Schaller's "A Lamentation for the Vacant Skies of Terra." It is a magnificent painting. How could I obtain an original piece of artwork or print by Schaller?

Dieline Coleman
Phoenix, AZ

Adolf Schaller is one of the artists whose works will be offered this year through FUTURE LIFE*'s Space Art Club. High quality, fine art prints will be offered at a later date in this magazine—both signed and unsigned.*

SPACE AWARENESS

. . . I have followed FUTURE since the first issue and congratulate you on its high quality. I finally joined the L-5 Society in response to a write-up in an early issue and have organized two local groups in Buffalo and Rochester. We hope to have a state organization by the end of the year. Your space science oriented articles have been a welcome addition to our growing library of literature, photos, slides and posters for use in our programs and displays.

Recently I sent a request to New York Governor Carey that he proclaim July 20, 1979, the tenth anniversary of the first Moon landing, as Space Day. I just received a very speedy and negative reply.

California, Massachusetts, Alabama and Texas have all declared space awareness days. Perhaps a letter writing campaign could be started in other states. We (the Niagara Frontier L-5 Society) are urging our friends around New York State to write Governor Carey, Executive Chamber, Albany, N.Y. 12224. Individual, to-the-point, polite letters are more effective than petitions, and a flood of identical letter forms have almost no effect.

This is the Massachusetts proclamation:

"Whereas: The achievements in space by many nations have enriched the lives of Earth's inhabitants, from expanded employment in many fields and through the development of new technologies; and

"Whereas: The Apollo lunar missions, and present and future activities in space demonstrate that our planet is part of a vast and expanding system, rich in opportunities, a 'High Frontier' which will renew the spiritual qualities that built the United States; and

"Whereas: Many citizens and industries of Massachusetts have participated in and contributed greatly to these historic activities in space; and

"Whereas: July 20 is the anniversary of the Apollo 11 lunar landing mission, when two Americans became the first men of our planet to walk on another world, saying, 'We came in peace for all Mankind,'

"Now, therefore, I Michael S. Dukakis, Governor of the Commonwealth of Massachusetts, in accordance with Chapter 124 of the Acts of 1972, do hereby proclaim that July 20 shall be known as Massachusetts Space Awareness Day, and urge the citizens of the Commonwealth to take cognizance of this event and to participate fittingly in its observance."

Thanks for your help. Keep up the great work in helping to make our society more space and future oriented!

By the way, I enjoyed the article in FUTURE

(continued on page 8)

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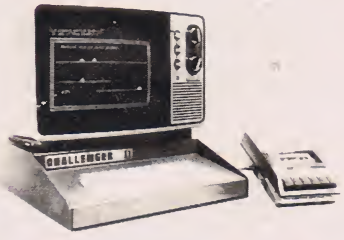

Ohio Scientific C2-4P $598

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input

8 on EarthSat. Could you please give me the address of Earth Satellite Corp.?

Elissa Wynn
Williamsville, NY

Thank you for the work you are putting in towards recognition of the large contribution our space program has made. We hope that many of our readers will follow your lead and write to their state leaders urging the equivalent of Massachusetts' Space Awareness Day.

Re: your request on EarthSat, you may write to Earth Satellite Corp. at 7222 47th St. (Chevy Chase), Washington, D.C. 20015.

ERRATA

In FUTURE LIFE #9's Databank lead story, we said the picture of Senator Harrison Schmitt in space suit was taken just prior to his voyage to the Moon on Apollo 18. Since there was no Apollo 18, we must have meant Apollo 17, the last voyage to the Moon. In Future Gallery, we said Ludek Pesek's art was also to be seen on the contents page. Wrong, that was Ron Miller's view of the Martian polar cap. And on page 48 and 49, the planetariums and their captions were switched. Chicago's Adler Planetarium is the one with Copernicus out front. The planetarium with the palm trees is Tucson's Flandrau.

FUTURE PRESIDENTS

. . . As 1980 draws closer, we will once again have to choose a president. Let us join together now to help see that the man we choose will be someone who will best serve the high ideals of this publication and its readers. Issues such as solar energy, health research and space programs deserve a fair shake in Washington, D.C.

I hope to see a new national organization dedicated to working at selling the future.

Rory Groner
Mt. Airy, NC

THANKS FROM ARCOSANTI

. . . Since Michael Cassutt wrote the article about Arcosanti and the Cosanti Foundation, we have been receiving many inquiries from all over the United States, referring to the article in FUTURE #8. We would like to thank you and also tell you that we appreciate it very much. Your magazine has brought us much favorable publicity. Again, we cannot thank you enough!

Aleis Ellwood
The Cosanti Foundation
Scottsdale, AZ

COMPUTERIZED HOMES

. . . I enjoyed the story in FUTURE #8 about the computerized house. I have two questions: What would be the size of such a complex and its power intake? Does anyone build this type of computer at this time?

Kevin Hall
Castlewood, VA

The computerized house imagined in that scenario could be run on a computer no larger than most personal computers now on the market. Additional boards, custom-designed to do household tasks, would likely be added on. It's not so much that a specific computer would have to be built to do these tasks, but that the software would have to be written and the interfaces rigged up. Of course, the ideal is to have the house built after the computerized systems are designed. It will be more difficult to computerize existing houses.

SPACE ART

. . . Thanks for the *Space Art* book. The engravers did a beautiful job and text by Ron Miller was very interesting. Books like this will help to create public interest and, as a result, encourage publishers to produce more, as we still have much to learn about outer space.

Chesley Bonestell
Carmel, CA

Our thanks for participating in Space Art. . . *and congratulations to the dean of American space art on his 91st birthday, celebrated on January 1, 1979. And thanks for helping kick off the first issue of FUTURE with your popular Portfolio/Interview: The Master at 90.*

DIFFERENT CUSTOMS

. . . One of the differences between the customs of our countries has become apparent since you ran a note about David Hardy prints, posters and slides along with his Portfolio Interview in FUTURE #8. In England we have the strange habit of throwing away envelopes and keeping letters; it seems, though, that some Americans put their address on the former but not the latter. Thus, as we now come to send out lists to the many readers who requested them, we find only a name — the addresses have been taken away by the dustmen (trash collectors?). . .

If those concerned would care to write again, without enclosing international reply coupons (some didn't the first time), we shall be glad to send the details they otherwise vainly await.

Incidentally, for British readers, *The New Challenge of the Stars* is published in the UK by Mitchell Beazley Ltd.

Lawrence Keene
Astro Art
Birmingham, England

BOOK SEARCH

. . . I am writing in response to your article "SF Artbooks and Illustrated Fantasies" in the In-print section of FUTURE #7. I would like information on how to order *The Flights of Icarus* (A&W Visual Library).

Michael Crummey
Selma, AL

You may write to A&W Visual Library at 95 Madison Ave., New York, N.Y. 10016.

NEW FROM THE PUBLISHERS OF STARLOG

If you are a young filmmaker with a special interest in science fiction, special effects and the limitless magic of the cinema. . .

THIS IS YOUR MAGAZINE

CINEMAGIC

For several years CINEMAGIC has been one of the most popular and most important movie fanzines published, but like all fanzines, it has been very limited in distribution. People have heard of it, but most young filmmakers have never actually seen a copy. Back issues are expensive, rare collectors' items now. It's almost a mythical underground legend. . . like the lost continent of Atlantis.

But now that will change. The publishers of STARLOG have joined forces with Don Dohler, the originator of CINEMAGIC, in order to produce a new, exciting version of the magazine that will enjoy wide distribution (only by subscription and in collector shops—no newsstands!) and will include photo articles about pros as well as amateurs.

CINEMAGIC will feature full-color photos, diagrams and design art and will guide readers, step-by-step, through the challenging techniques of backyard moviemaking. CINEMAGIC is a must for everyone who enjoys behind-the-scenes film work and everyone who is aiming toward a professional career in any aspect of the movie world.

Published quarterly (4 times a year) CINEMAGIC is available by subscription and in limited local stores only!

To be certain that you do not miss out on a single data-packed issue of CINEMAGIC, we suggest that you send in your subscription order TODAY!!!

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* How to produce professional titles that move, change color, melt, sparkle, burst into flames, zoom into space. . . all for a few bucks!
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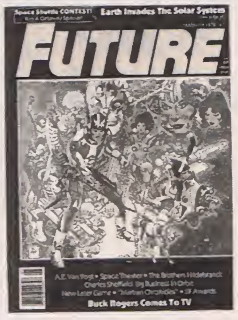

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Written by Doris Vallejo

Historic in several ways, this is the first book Boris has illustrated for children, as well as his first published collaboration with his writer/wife, Doris. Done especially for STARLOG/FUTURE, this imaginative fable of space is destined to become a modern classic in youth literature.

Beautifully printed in vivid full color on every page, this horizontal-format, hardbound book (complete with dust jacket) can be found in select book store outlets or can be ordered directly from the publishers. It will make a wonderful holiday present that will be re-read and treasured for years to come.

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BIG-BUDGETED BANG THEORY

"METEOR" HITS BIG

In a few months, American International Pictures will be releasing the biggest picture in the 25-year history of the company—the $17 million science fiction extravaganza, *Meteor*. Based on the M.I.T. Project Icarus study, the film dramatizes the awesome events that take place when a comet smashes through the asteroid belt, sending a five-mile-wide fragment on a collision course with Earth. The meteor is preceded by a horde of equally deadly smaller fragments which wreak havoc in metropolises around the world.

In order to tout the hard-hitting film in advance, AIP has devised one or two smashing ways to reach the public at large. Currently being distributed to schools around the nation are specially designed *Meteor* Classroom Learning Guide Kits. Developed by a team of educators and scientists, the kits are designed to supplement present curriculum or be used as an educationally sound mini-course. Much of the material was compiled from research done by NASA, Caltech and JPL for the movie's technical background.

Included in the kits are mounds of information on asteroids, including photos and data; comets and their place in space; meteors; meteorites; past and present meteorite impacts on Earth, with photos of the most spectacular; and the solar system in general. Rounding out the educational hype handouts are wall charts, project sheets and photos from the movie, *Meteor*. (For information on how to obtain the *Meteor* Classroom Learning Guide Kits, write to American International, 9033 Wilshire Blvd., Beverly Hills, CA 90211).

PHOTO: © 1977 JAMES R. GLOBUS/AIP

Meteor's New York computer central falls apart under pressure when the space rock strikes.

On a slightly less educational note, AIP is also dispensing special *Meteor* insurance policies to key movie critics and writers around the country. The bona fide policies, drawn up by Massachusetts Indemnity and Life, insure their holders against the risk of meteor attack. Each holder is insured for $50,000 in case of accidental death or dismemberment from an injury sustained as "the result of a falling, natural, non-man-made meteor." (Sorry, Skylab fans.) The policies are good up to and including the date on which the movie premieres.

Several New York writers on the insurance mailing list thought the *Meteor* insurance policies a great idea and were last seen in Central Park, tossing large rocks in the air and standing beneath them, yelling "Look out, it's finally Kohoutek!!"

—Ed Naha

COMING ATTRACTIONS

SKYLAB GETS DOWN

Skylab will fall from the sky this year sometime between May and September... possibly as early as April, if NASA loses all control and the 80-ton space station begins to tumble violently. Most likely, it will fall in late June or early July.

It will leave a "footprint" 4,000 miles long and 100 miles wide. It will break up into 4,000 or 5,000 pieces, an average of less than one piece landing in every 100-square-mile area of its "footprint."

The largest piece that will land whole is a 5,000-pound, solid metal airlock shroud which, according to NASA public affairs, looks like "a giant napkin ring." Other large things landing in one piece will be a two-ton, lead-lined film vault and several hefty oxygen tanks.

If Skylab's rain of space junk causes any death or destruction, the U.S. Government picks up the tab. At least it's not radioactive.

According to some Skylab fans, there's still a chance for the Russians to reboost America's only space station to a higher orbit and keep it in space until the shuttle can reach it. But at a press conference last December, NASA official John Yardley indicated the Russians hadn't yet offered a helping hand—or a spare Soyuz.

It became evident late last year, when the first shuttle launch was again delayed (now the target date is November 9, 1979), that NASA would not have a good chance of reaching Skylab in time to save it. So the space agency adjusted the station's angle to face its solar panels toward the Sun. The adjustment did two things: it will allow the batteries to store up power, which will help NASA try to make last-minute maneuvers once the thing is on its way down; but it also shortened the station's orbital life, causing it to come down almost a year earlier than it would have naturally.

The space agency may not be too cheerful about Skylab's imminent fiery finish, but the publicity squad for *Meteor*—set to premier in a few months—couldn't be happier.

—Robin Snelson

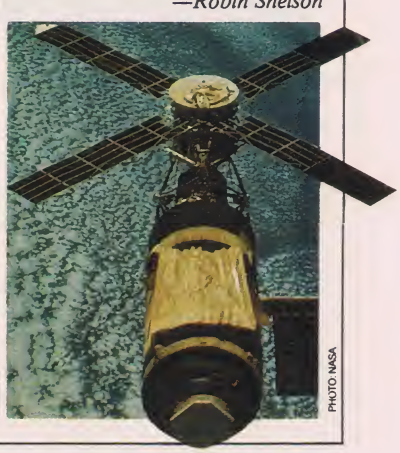


PHOTO: NASA

INFORMATION

NASA'S SPACE FILMS

In response to frequent requests for films about space, NASA has made a series of seven outstanding short features available to the public. Included are such prize-winning documentaries as *Universe*, narrated by William Shatner, which was nominated for a 1977 Academy Award; *Who's Out There?*, narrated by Orson Welles, which presents the contemporary scientific conclusion that intelligent civilizations exist elsewhere in the universe; and *A Question of Life*, a composite of three shorter works which present almost everything currently known about Mars relating to the possibility of life there...and also considers the possibility of life elsewhere. These films are provided in either 16mm or videotape. A descriptive brochure detailing length and prices may be obtained by writing the National AudioVisual Center, Washington, D.C. 20409.

SPACE NEWS

NASA NAMES SHUTTLES

The National Aeronautics and Space Administration has named the first four space shuttle orbiters which will operate in space after sea vessels used in early world exploration.

Orbiter 102, scheduled to be launched into Earth orbit late this year, was named *Columbia* after the ship that first explored the mouth of the Columbia River in 1792. Orbiter 099, the revamped "structural test article," is called *Challenger* after a vessel which cruised the Atlantic and Pacific oceans from December 1872 to May 1876. Both these designations have been used before by NASA for its space vehicles.

The remaining two shuttles, *Discovery* (Orbiter 103) and *Atlantis* (Orbiter 104) have also been named after sea-going vessels of the past.

It is well known that *Enterprise*, the first orbiter constructed and the one used for the 1976 approach and landing tests, was named after *Star Trek*'s famous starship. What may not be quite as well known is the fact that the *Enterprise* will never actually travel in space. After several additional tests, *Enterprise* will not be considered flight-worthy by NASA, and will probably end its career as a museum piece.

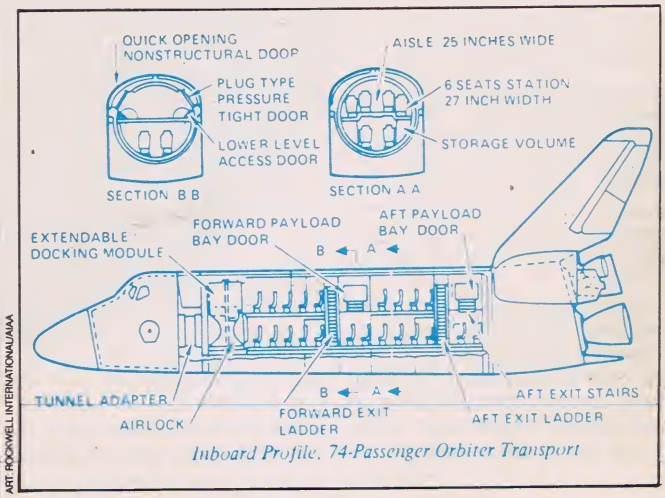
—Barbara Krasnoff

TRIP TO ORBIT

PASSENGER-CARRYING SPACE SHUTTLE?

ART: NASA

Above: An artist's concept of the space shuttle after placing the large space telescope into orbit 500 kilometers above the Earth. The shuttle will carry the telescope into orbit sometime in 1983. Some scientists believe the universe was formed nearly 14 billion years ago. Since this telescope will be able to detect light as far away as 14 billion light years, it may provide views of the very first galaxies at the time they were formed! (About two billion light years is as far as the famous Hale telescope at Mt. Palomar can see.)
Below: A cross-section diagram of current plans on how to modify the space shuttle to launch 74 passengers to orbit.



ART: ROCKWELL INTERNATIONAL/AAA

Inboard Profile, 74-Passenger Orbiter Transport

The people who are bringing into our galaxy the U.S. space shuttle, Rockwell International, have come up with a space fan's dream come true—the 74-passenger space plane!

The Rockwell design is part of a continuing investigation to alter the basic space shuttle transportation system, enabling it to place larger and heavier payloads into orbit, remain in space for longer periods of time, and lift more than seven crew members (as currently planned).

Key to the space commuter plan is conversion of the shuttle orbiter—the space plane which flies into Earth orbit—to carry a "passenger transport kit." This modular kit would fit into the cargo bay, normally packed with satellites, experiments, or the European-built Spacelab. Rockwell engineers estimate that room for 68 people exists in such a module, with an additional six seats to be located in the orbiter's lower flight deck, below the pilot and crew cockpit.

The passenger compartment includes special exit ladders, stairs and doors for normal entry and unloading...plus extra bathrooms! Modifications to the orbiter's wings, life-support and environmental control systems are also necessary. No sleeping accomodations would be provided, requiring passengers to sleep in their seats—much like commercial airlines which offer those midnight, coast-to-coast flights known as "red-eye specials." Spacesuits would not be needed, and zero-gravity should lessen a traveler's concern about becoming uncomfortable. A one- to two-day flight would be possible with minimum launch and re-entry g-forces on passengers, say Rockwell planners. The estimated cost of modifying the orbiter is $220 million.

But before the public starts to form a waiting line to climb onboard, putting their money down on first class or coach seating, Rockwell adds a note of caution. As yet, a requirement for the orbiter passenger transport doesn't exist. It is possible, however, that decisions to build space stations, gigantic solar power satellites or orbiting communication platforms might necessitate space construction crews. If so, such a passenger space transport concept could be needed. And, as human spaceflight evolves into a routine, economical, and safer part of our daily lives, perhaps the commercial space liner will not be far behind.

—Leonard David

TELEVISION

SPACE JUNK SOARS ON "SALVAGE 1"

Some men rebuild cars for the fun of it. On *Salvage I*, Andy Griffith, playing Harry Broderick, a shrewd and highly successful salvage man, rebuilds a spaceship. His plan: to pilot his homemade spacecraft, *The Vulture* (below) to the Moon to pick up a mountain of abandoned NASA equipment and return it to Earth for a profitable re-sale. Further episodes pit Harry against robots, monkeys and icebergs.

PHOTOS: © 1979 ABC

One of the biggest stars to emerge on the tube thus far in 1979 is the *Vulture*. Not related in any way to the proverbial bird of prey, this 100-foot-plus vulture is made of junk, looks like a flying World War II washing machine and is the product of the creative mind of *Salvage I* producer/creator Mike Lloyd Ross.

In the ABC series' pilot script (which seemed to be a first cousin of Robert Heinlein's classic *The Man Who Sold The Moon*) the *Vulture* was pieced together from surplus NASA rockets and junkyard scrap by fictitious junkman Harry Broderick (Andy Griffith). "He's a wheeler-dealer, the kind of guy who can buy an oil derrick from the Arabs and sell it to the Israelis," explains Ross. "He knows where the world's greatest salvage haul is, but it happens to be on the Moon. It's the stuff left there by the Apollo astronauts, worth an estimated $12-15 million.

"He puts together a team and they work in his junkyard. They put together scrap parts and build a space ship. They pull it off, and make the haul. He wants to score — to be the top man in the junk business."

According to Ross, the initial plot is not as bizarre as it sounds. "The funny thing," he says, "is that we found enough parts left over from various government agencies to build the real thing—just as Andy does in the script."

And Ross insists that a homemade rocket, thus constructed, would be cheaper than an official NASA model. "The space program has been very expensive for understandable reasons," he says. "They've never had a death in space because their systems have a safety factor of 99.99 percent. With a homemade rocket, however, you don't have to be as strict. As one of my characters says, 'What's wrong with 80 percent. . . that's better odds than I get on the freeway.' "

Ross, reflecting on *Salvage*'s January debut episode, concedes it was the *Quo Vadis* plot of the season. "We had this problem. That was only the pilot story — what could we do for an encore?"

Answering his own question on the tube, Ross and his writers have come up with further *Salvage* stories concerning aliens in haunted houses, missing links, iceberg towing, finding missing WW II planes and sunken CIA spy ships and even trying to rescue a satellite about to plunge into Earth's atmosphere. If some of Ross' plots sound strange, yet scientifically sound, blame it on his years with the U.S. aerospace program. A former aerospace engineer, Ross claims that his film career was actually launched by the U.S. government. . . who encouraged him to do more with his free time by giving him more free time to do more with. "I was fired," he states.

—Joseph Kay

GARBAGE POWER

TODAY'S TRASH IS TOMORROW'S ENERGY

There are lots of things the world may be without in the future. Garbage is not one of them. As landfills start to grow literally from molehills to mountains, many towns and cities are beginning to fret. But not the town of Hempstead, New York, which recently transformed 4,000 tons of raw garbage into two million kilowatts of electricity—enough energy to power 14,300 homes for a week.

The technology for the trash-to-energy metamorphosis has been around for nearly a decade, but its practicalities are only now coming to fruition. In fact, the Hempstead project, which should be fully operational by mid-'79, is regarded as a forerunner to several similar plants in neighboring New Jersey, Connecticut and the rest of New York State. With a scarcity of new landfill sites, the high cost of burning and environmental regulations, many populated municipalities are turning to this as their prime means of disposal.

Landfills are not only overflowing but are arming themselves as environmental time bombs. There is an increasing risk of toxic pollutants leaching into water supplies, and trash-produced methane could dangerously migrate into nearby homes.

One of the major blessings of high-energy garbage, though, is that it not only provides a new power source, but is also cheaper than present methods of garbage disposal.

—Bob Woods

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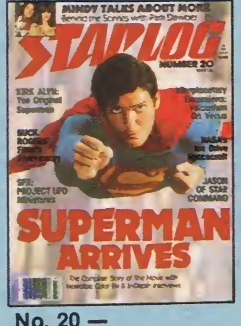

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FILM: BEHIND-THE-SCENES

"QUINTET" ICES THE FUTURE

Quintet is Robert Altman's latest movie.

Quintet is a five-participant board game played in the future.

Quintet is a five-assassin sport, lived and died in the future.

Quintet is also one of the most chilling films ever made... literally. Starring Paul Newman, Vittorio Gassman, Bibi Andersson, Fernando Rey and Brigitte Fossey, the movie was filmed on location around Montreal during one of that area's severest winters ever. *Quintet*'s futuristic ice-civilization required little or no special effects in order to achieve a glacier-like image on screen. During the shooting of the movie, temperatures were always below freezing and often below zero.

Tommy Thompson, producer-director Altman's longtime aide and executive in charge of production, states unequivocally: "No feature film ever was made under similar conditions; I've checked with a lot of people in the business." A majority of scenes for the film were constructed in an immense steel grid building on the Ile Sainte-Helene in the middle of the St. Lawrence River, with sets welded to withstand the strong winter gales. What nature didn't cover with ice and snow, the crew did — by spraying water every night on the sets.

"Every piece of equipment required adaption for the cold," says Thompson. "The cinematographer, Jean Boffety, had to cover the camera and mount a warming element near the lens to keep it from freezing. On a smaller scale, the actors, all with individual microphones, wore handwarmers next to the belt-held batteries, since extreme cold drains batteries fast."

The actors, forced to film some scenes in 40 degrees below zero temperatures, donned makeup and costumes in a normally heated building, then moved to what Thompson calls the "decompression chambers" of their dressing trailers, which were warmed from 45 to 50 degrees, before climbing out into the frigid Canadian air. To fight the cold, both actors and crew members carried handwarmers and wore multiple layers of thermal underwear and clothing made of thick, heavy materials that sometimes froze to the ice if a player was required to stand still for a couple of minutes. On one occasion, a crewman fell into the river while moving some cables. His clothes froze so quickly he had to be carried, robot-like, to a car and rushed back to the city for thawing.

Another risk encountered in Altman's future-freeze: spills and falls on the ice sheets. Tons of salt and sand were spread to cut down on this hazard... to no avail. The salt melted the ice and the resulting slush would then freeze over again. "Most of us took some falls," recalls Thompson, "but it was hardest on the actors. They had to walk on ice and look nonchalant about it while performing."

Other accidents occurring in Altman's cold, cruel world: paint froze as soon as painters poured it into trays, prop bottles of liquor had to be refilled between takes in order to keep them in a liquid state, makeup froze and cracked, actors' hands were plagued by frostbite and the cast and crew often had to snowplow their way on and off the set.

Despite the wintry conditions, the cast and crew of *Quintet* completed the movie in record time. "Working in Arctic conditions like that was a once-in-a-lifetime thing," Thompson explains. "That's probably why no one complained. It was a big adventure to everyone involved." —*Joseph Kay*

PHOTO © 1979 20TH CENTURY-FOX

Paul Newman is Essex, the individualistic hero of *Quintet*.

CLIMATE CONTROL

WORLD WEATHER ACCORDING TO GARP

The most predictable thing about the weather these days is that it's so unpredictable. Now, a massive international effort, under way since January, hopes to change all that and, in the process, lend a bit more credibility to the local weatherman.

The Global Atmospheric Research Project, a year-long study with 147 nations participating, will focus in on the planet's seasonal weather cycle and determine how well present forecasting technology works.

A spokesman for the National Oceanic and Atmospheric Administration said that the data will be processed at several international centers and finally packed into a 12-month, multi-media, world weather history. "It'll be like a three-dimensional movie of Earth's weather," the spokesman said. —*Bob Woods*

ART: NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION

The Global Atmospheric Research Project (GARP) will use satellites, airplanes, ships, bouys, ground stations and balloons to help scientists monitor and predict world weather.

ENVIRONMENT

OZONE WARS

Scientists are still worried about possible depletion of the ozone layer in the upper atmosphere that protects Earth from harmful ultra-violet sunlight, and what one author called "The Ozone War," may soon escalate.

A prestigious American scientific institute is preparing a study of the problem for release later this year, but a spokesman for the organization said, "we'd rather not be named... all publicity gives us trouble. People call up and ask what's in a report that isn't finished yet."

The ozone issue is a volatile one because the gas, freon, which causes the problem, is essential to refrigeration. While Congress banned non-essential uses of the gas (in aerosol cans, for instance), other countries have not, and its use in air conditioners, refrigeration, and so forth may actually be increasing. A World Meteorological Organization report states that enough freon is being released into the atmosphere to cause a five percent depletion of the ozone layer over the next 20 years. By 2010 it could reduce the layer by 15 percent, at which point the shrinkage should stabilize due to regeneration of ozone by nature.

Freon is a tasteless, odorless, harmless gas that is so stable chemically, it does not break down in the environment until it reaches the stratosphere. There, attacked by ultra-violet light, it is reduced to its component parts, one of which is chlorine. Chlorine destroys ozone.

Yet scientists disagree on what effects the gas has on the ozone layer. "You almost have to assume that if it's produced, it's going to be released," said our source, "but there is still debate about what effects it will have on the ozone layer. It could be it won't decrease it much, or it could be it will decrease it enough to cause worry. There are still some scientists who argue it may actually increase the ozone."

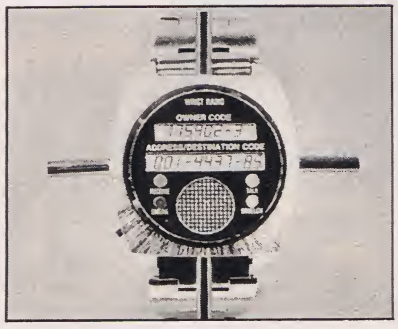
The biggest fear is that a small decrease in the ozone shield might lead to increased skin cancer and mutations caused by more exposure to ultra-violet light.

Another problem scientists face is that they are not sure what, if anything, can be done about the problem. "No substitute for freon as a refrigerant has been found yet, so you certainly can't call it non-essential," noted our source. He recommended reading *The Ozone War*, by Harold Schiff and Lydia Dato, for a thorough overview of the problem. The Institute's study, he said, would be made public upon completion.

—*Allan Maurer*

HARDWARE

FUTURE PHONES



The phones of the future, counter-clockwise from above: Pathcom's decorative EZ Phone, the Dick Tracy-esque wrist phone, the Model 2500/B Rovafone and the long-range designed Mectron model.

Dick Tracy fans, take note. A small portable phone which resembles Tracy's famed wrist radio may be developed to work in conjunction with very large satellites, and, in about ten years, provide us with a totally mobile and convenient means of communication.

According to a study done by Science Applications, Inc. for NASA, these wrist radiophones will operate through the use of microwave signals bounced off geostationary communications satellites. By reciting the appropriate code into the transmitter, a caller will send a signal through a computerized switchboard built into the satellite, which will then transmit the call to the correct party. (By the way, the computer will also notify the phone company to bill you.)

The study states that the technology for this type of telephone system already exists and that it could readily be developed into an inexpensive and viable communications network. Once in orbit, a satellite handling 1,000 microwave beams could serve a minimum of 10 million users. Since the major bulk of the hardware needed for such a complex system would be contained in the massive satellite itself, the ground stations can

shrink to the size of a wristwatch.

The initial cost of developing, building and launching the satellite system would be about $300 million, but Science Applications thinks that profits derived through the use of these wrist radiophones could more than justify the original investment. And the eventual cost to the public? About $10 per phone and around 60¢ per call.

However, if you're unwilling to wait for these tiny telephones to become available, there are several cordless phones now on the market and ready for use. In fact, they have been around for several years, but are only now being marketed to meet the needs of the general public.

The cordless telephone is usually made up of two separate units: the phone itself, which can resemble anything from a Trimline to your basic walkie-talkie, and its base adapter, which attaches easily to the normal telephone system to provide a signal source.

Pathcom Inc.'s EZ Phone is a decoratively styled system which allows the user to answer and make calls up to 300 feet from the base adapter. Incoming calls are accepted by raising the antenna and flipping a mode switch from standby to on. To hang up, collapse the antenna. Group calls are also possible through the use of several cordless phones; a built-in security system prevents anyone else from using your system once the phone is hung up in its base. The EZ Phone is retailing for about $170 per unit. (Pathcom Inc., 24049 South

Frampton Avenue, Harbor City, Calif. 90710.)

Fracom/Rovafone International recently introduced their Model 2500/B Rovafone. The styling is more utilitarian, and the effective operating range averages about a third of a mile. Special features include a 16-digit memory of the last number dialed, automatic redialing and an "energy saver" circuit which provides 40 hours of "standby" time before recharging is needed. Suggested retail price is about $650. (Fracom/Rovafone, 2130 West Clybourn Street, Milwaukee, Wisc. 53233.)

Those who are interested in wandering longer distances may be attracted by Mectron's long-ranger, which will transmit up to two miles from its base adapter under ideal conditions, retailing for $700. (Checkmate Communications, Ltd., 72-09 Queens Boulevard, Woodside, N.Y. 11377.) *—Barbara Krasnoff*

FUTURE FOOD

INTRODUCING THE ULTIMATE DRY MARTINI

By the year 2000, consumers are sure to have an array of futuristic goodies at their disposal, from personal computers to solar-energized homes. But what about the future of food? According to some experts, there are plenty of surprises in store. Some of the more exotic items include powdered martinis, imitation caviar and dehydrated butter.

The two most prominent trends mentioned by forecasters are the widespread development of aquaculture—underwater "farming" of marine life—and an increasing move toward vegetarianism. Gourmets will be happy to know that predictions do not include a diet of little red pills or worms, grasshoppers and termites.

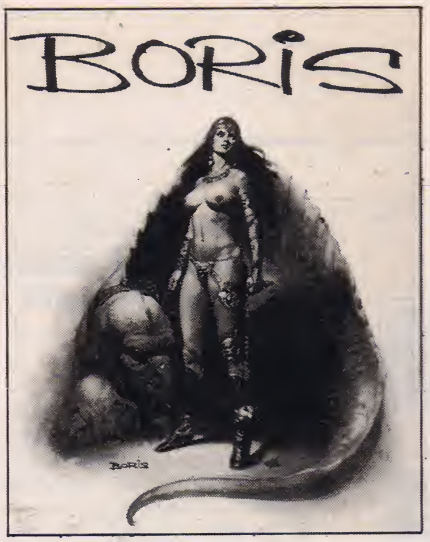
It seems that consumers still want real food, and researchers are hard at work to find better ways of producing it. Experimenters are already breeding polyunsaturated cows, leaner chickens, 30-40 pound turkeys and more vine-ripened vegetables grown indoors. Scientists have even come up with a featherless chicken, but it seems that the plucked bird's nakedness resulted in such emotional and physical trauma that experiments have all but ceased.

Aquaculture has had more positive results. At San Diego State University, unique "soft-shell lobsters" have successfully been grown in the effluent waters of the city's utility plant. And since aquaculture has no legal size minimums as in conventional methods, quickly grown marine life is a real future possibility.

Though experts predict that fruit and vegetables probably won't look any different by 2000, produce may likely undergo some nutritional alterations, such as the inbred addition of essential vitamins and minerals.

Research into new preservation techniques is aimed at reducing the ever-rising energy costs of keeping food. If items contain less water and do not require refrigeration or freezing, millions of dollars can be saved in shipping and storage methods.

All scientists are not so optimistic, however. Some worry about the psychological side effects of too much fake and prepared food. Just imagine, they say, sitting down to a sizzling pizza oozing with mozzarella cheese fabricated from vegetable fat, and sausage made of textured soy protein. Bon apetit! *—Bob Woods*



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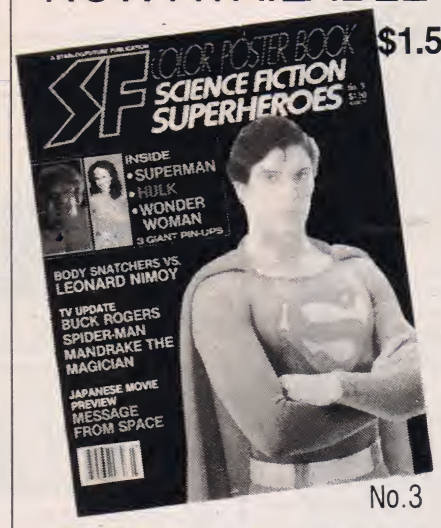

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ENERGY ALTERNATIVE

SOLAR CHICKEN HABITATS

Some would say that it was inevitable. You've got your solar space heaters. Your solar cookers. Your solar water heaters. And now, thanks to a visionary flock of engineers at the Georgia Institute of Technology, you've got your solar chickenhouses.

Lamar Hicks, a Georgia Department of Agriculture inspector who operates a trio of broiler houses on his farm in Cumming, Georgia, is the proud owner of one of the country's first full-scale solar-heated poultry houses. Hicks' avant-garde system was installed on an existing growout house (where chicks are raised to maturity) in May of 1976, compliments of Wilson Foods (the grower for whom he raised the chickens), which footed the bill; and Georgia Tech's engineers, who designed the quarters.

The solar system received glowing reviews for its performance during the winter of 1976-1977, its maiden season. The design called for the device to augment the gas heat in one of Hicks' 18,500-bird houses; it actually provides 47 per cent of the copious quantities of energy needed to keep the chickens cozy. And, of course, it saves the Georgia farmer a healthy sum on his imposing gas bill.

Including materials and labor, the tab for the solar unit was a pricey $6,600; but a Georgia Tech spokesman estimates that the device will pay for itself by 1983. All of the construction work was performed by a Cumming man, and the plan is so elementary that any enterprising poultry farmer could fashion his own backup heater: The heart of the 208 x 16-foot solar collector is a rectangular pit filled with 80 tons of black-painted granite; it lies on a 30-degree slope abutting the growout house. The rock bed is sheathed with wood-framed panels of polyethylene. The stones absorb the sun's heat, which is channeled (via convection) into the broiler quarters. Simple caps on the feeder pipes allow Hicks and his helpers to unharness—or stem—the flow of heat, and a flock of fans keeps the place properly ventilated.

Since the growout stage is the most energy-intensive phase of the fowl-producing process, the poultry industry has been understandably enthusiastic about reducing the consumption of costly fuel at that point. "There've been people from California, Arkansas—all over the country—come to see this house," Hicks says. "They've been trying to see if they can improve on what we've got." He says that neighboring farmers and a frankly-curious contingent of locals have turned out in force, as well.

So far, the Georgia experiment has met with just two obstacles, both minor. Rats tracked clots of litter into the system when they worked their way through conduits carrying heated air into the chickenhouse, and one fun-loving farmhand clogged pipes by chucking full-grown fowls down an air duct.

John Giles, assistant research engineer at Georgia Tech, says that the solar chickenhouse concept looks so promising that Tech's solar specialists engineered and built another experimental device in the spring; this one, a rooftop model in Villa Rica, Georgia. "A group from the Department of Energy in Washington came down to review the environmental impact of the Cumming project not long ago," he says. "They told us it was highly appropriate for the application, which is what everyone's looking at now." But the most important test of the system's mettle, Giles observes, is "whether the people who use it feel it's good."

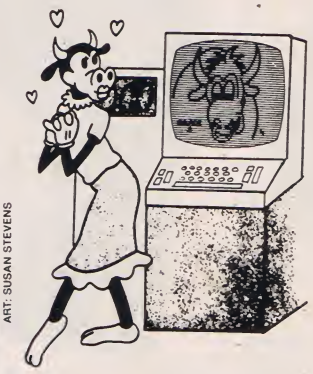
"I'm all for it," farmer Hicks reports. "I'd install the same thing in my other houses, if I had the chance. Anything you can do to cut operating costs helps, and the price of gas won't go anywhere but up from now on."

So far, there's been little comment from Hicks' feathery broods. Save one: When a recent visitor inquired about the advantages of solar heat, they replied tersely—and in unison—"Cheep." —*Michelle Green*

HAPPENINGS

SPACE ART ON VIEW

The premiere private exhibition of original artwork from *Space Art* opened in February at a brand new Washington, D.C., restaurant appropriately called The Planet. A dozen original paintings from the book were on display in The Planet's futuristically designed Press Club and Gallery. *Space Art*, compiled and written by STARLOG/FUTURE LIFE Space Art Advisor Ron Miller and published by Norman Jacobs and Kerry O'Quinn, is currently being condensed by *Reader's Digest*.



ART: SUSAN STEVENS

COMPUTER DATING

BUILDING A BETTER COW

Can modern technology build a better cow? The Holstein-Friesian Association of Brattleboro, Vermont, is trying to find out by matching cows and bulls with a computer.

The bovine computer dates are not likely to produce any lasting romances, however. After being matched with an appropriate bull, cows are artificially inseminated, so the mates never meet. They are producing results the Association wants: over a four-year period, Holsteins in the program have given an average of 1,000 pounds more milk, an Association spokesman said.

Experimentally, the computer is being used to help the Association's 27,000 dairy farmer members improve Holstein health, nutrition and milking methods. Information on more than 10 million cattle, from a century ago to the present, is stored in the computer and on microfilm.

—*Allan Maurer*

CONFERENCE

"THROUGH THE 80s"

The World Future Society will be holding its third General Assembly in Toronto, Canada on July 20-25th, 1980. The theme of the conference will be "Through the Eighties" and it is being held in conjunction with the fifth annual conference of the Canadian Association for Futures Studies. Anyone interested can write the World Future Society at 4916 St. Elmo Ave. (Bethesda), Washington, D.C. 20014.

EXTRATERRESTRIAL FARMING

VEGETABLES—SPACE COLONY CUISINE?

Build vegetarian starships," exclaimed Dick Stafursky at a recent conference celebrating the second World Vegetarian Day. Stafursky, who is part of the Society of Vegetarian Biologists, vehemently argues that "future space colonists should have compassion for other species. We're totally against placing animals in space to feed people."

Lofting animals into space, because of their size and weight, looks impractical. Believing that early settlers may be forced to create their own space plantations, Soviet scientists suggest the sweet potato as a most suitable crop for artificial worlds. This research is boosted by NASA studies which indicate that plants raised in zero-gravity are more nutritious and produce less fiber and more digestible materials than gravity-tied Earth plants.

Even bolder research is being conducted at the Battelle Pacific Northwest Laboratories in Richland, Washington. Peter Molton and Ted Divine of the Food and Agriculture Section visualize growing food stuffs on asteroids! With the creation of space colonies, Moon and Mars bases, as well as asteroid mining, a supermarket in the stars would make economic and logistical sense. The scientists have centered their studies on insuring that the asteroid Ceres will live up to her name—the Roman 'goddess of Agriculture'!

On Ceres, conditions look favorable to farm crops under plastic hemispheric domes, coupled with systems of mirrors to concentrate sunlight. Each one-acre complex would contain parallel rows of soybeans, cabbage, spinach, potatoes, and other leaf vegetables, cultivated using a "vertical agriculture" technique. This method is now in use on Earth, in highly mountainous regions with large population densities.

The researchers believe Ceres could be transformed to the "breadbasket of the solar system," exporting its precious crop to selected locations, like manna from heaven.

As Molton and Divine have concluded, early American colonists had no better on Earth, "so why should it be different in space?" Future colonists take note. Be prepared to hear that old parental command—"*Eat your vegetables*"—at least till McDonald's opens a franchise!

—*Leonard David*

CONTEST WINNERS

SPACE ART SEARCH

On the 20th anniversary of the establishment of the National Aeronautics and Space Administration (NASA), STARLOG and FUTURE LIFE joined forces with the National Space Institute (a Washington, D.C.-based organization founded by Wernher Von Braun to bolster public opinion of the space program),in a pilot project called Chicago Spacewatch. The National Space Institute, NSI, sponsored a variety of programs, lectures and exhibits in the Chicago area during the month of October, 1978. The goal was to stimulate public awareness of the benefits and promise of space.

STARLOG and FUTURE LIFE's participation was two-fold: An exhibition of space art was displayed at the Chicago Museum of Science and Industry, art featured in the magazines and in the book, *Space Art*.

But the big event was STARLOG/FUTURE LIFE's Space Art Search, held among the Chicago high school students. An exhibit of student space art—finalists from all participating high schools—was on display at the Richard J. Daley Civic Center in November. Publishers Norman Jacobs and Kerry O'Quinn, plus space artists Ron Miller and Vincent DiFate, traveled to Chicago to view the artworks and award First, Second and Third prizes in two divisions: Senior (11th and 12th grades) and Junior (10th and 9th grades).

The winners: Senior Division—First, Enrico DeGuzman, Sullivan High School; Second, Jeffrey Casey, St. Lawrence H.S.; Third, James Sonzero, Holy Cross H.S. Junior Division—First, Brenda McClinton, Hirsch H.S.; Second, Theresa Mills, Rezin Orr H.S.; Third, Alberto Guerrero, Holy Trinity H.S.

Admittedly, there were a few glitches involved in the project—and to Chicago area students who wrote to us complaining that their schools did not participate in the Space Art Search, our regrets. One thing we learned in the process is that, as national magazines, any competitions we hold in the future will be open to *all* readers and not on such a local scale. In the long run, however, STARLOG/FUTURE LIFE's Space Art Search had its great moments. As artist/judge Vincent DiFate reflected, upon his return from Chicago, "The magic in the eyes of those children made this effort seem so worthwhile. They care about the promise of space and for many of them, this project did indeed open up a new realm of thinking. No longer was the space program a money-wasting abstraction. It was a means of hope, a way of getting out."

Mission accomplished.

Clockwise from top left: Winning artworks by Enrico DeGuzman, Theresa Mills, Brenda McClinton, Jeffrey Casey and James Sonzero. Alberto Guerrero's art missed our press deadline.

SPACE ART CLUB Print #3, "The Dream Fulfilled" Painted by Vincent DiFate

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JANE FONDA'S "China Syndrome"

By NANCY NAGLIN

It's important that someone who's associated with social movements can show that it's possible to take controversial stands and stick up for what you believe," says Jane Fonda about her latest movie, *The China Syndrome*.

In developing the premise for this nuclear power plant thriller, Fonda admittedly was influenced by the controversial death of Karen Silkwood, a concerned citizen who was mysteriously killed as she was about to turn over evidence to *The New York Times* concerning a large quantity of plutonium "missing" from a nuclear power plant.

"We wanted to do a movie about that," Fonda recounts. Sequestered in her Los Angeles home, she pauses for a second, obviously relishing the repercussions that *The China Syndrome* is bound to cause within the ranks of the energy industry. "However, we couldn't get rights to the story and we couldn't fictionalize it properly."

Luckily, Fonda and co-producer Bruce Gilbert discovered a script written by aeronautical engineer and technical writer Mike Gray. It was the story of a life-threatening failure at a nuclear energy plant. Initially there was no woman character in the script. But Fonda had been reading a series of articles in the *Los Angeles Times* by Robert Scheer about the packaging of TV newswomen, so she created the role of Kimberly Wells.

In *The China Syndrome*, Wells is on assignment to do a light news feature on a nuclear power plant. She is accompanied by freelance video filmmaker Richard Adams, played by Michael *(One Flew Over The Cuckoo's Nest)* Douglas. While outside the control room of the reactor, they inadvertently witness an accident in the plant. They surreptitiously film Jack Godell (Jack Lemmon) in the process of trying to stabilize a "transient" or off-normal condition.

PHOTO © 1979 COLUMBIA PICTURES

Mixing real-life blunders with reel-life cover ups, "The China Syndrome" warns of the ultimate nuclear accident.

The accident they have witnessed could hypothetically trigger the dreaded "China syndrome." Greg Minor, the technical consultant for the movie, is an electrical engineer who worked in G.E. nuclear power plants for 13 years. He describes the syndrome as the catastrophic result of a melt-down in the core of the reactor. "If the reactor is insufficiently cooled," explains Minor, "the thing sits there like a corked bottle, building up pressure."

In a real nuclear power plant, the nuclear material is sealed in zirconium tubes and placed inside a steel pressure vessel. The vessel is called the core and is generally built above ground but fairly low in the structure of the plant. In a light water reactor (some Canadian plants use heavy water) like the one in *The China Syndrome,* water of about 500 degrees Fahrenheit is constantly washing over the core, cooling the 1000-degree F fuel inside.

In *Syndrome*, the crisis occurs when the reactor begins to generate more power than the turbine can use. Godell, however, doesn't know he is reading a faulty instrument panel. He misreads the situation and orders more water to flood the core, when his real problem is that there is too little water available.

In both real and reel life, if the core temperature reaches 3000 degrees F, the zirconium shield could perforate, deform, burst or melt. "It could melt through the pressure vessel that contains it," says Minor, "and the China syndrome idea came from wondering, once it melts through the pressure vessel and through the concrete below it, where would it stop? Conceptually, it would keep on going to the middle of the Earth."

In the film, that's the conclusion envisioned by the Wells and Adams characters. But when they try to tell their television bosses of the peril or enlist the aid of a clearly shaken Godell, they run into a brick wall. People would rather see Wells do cute stories about zoo animals on TV, she is informed by network heads. Meanwhile, Godell fights back panic by trying to convince himself that the plant's systems are really fail-safe.

Making the situation more believable are the performances by all those involved with the film, most notably Fonda, who did her homework on all topics concerned. For the Wells role, she tagged along with a TV news crew for months. "I want to make films about women in the process of learning what they're about," she says.

Kimberly Wells finally decides she's got to take a stand on the issue. She even needles the spineless Godell to do some soul-searching as well. "They were both salaried workers primarily concerned, in the beginning of the film, with job security. But in the course of a week, they opt for things beyond their self-interest," Fonda states.

One of the prime concerns of *The China Syndrome*'s makers was that the film accurately reflect reality. The characters had to be real and so did the situations. In their efforts to recreate the real world, they constructed a full-scale replica of a control room. The "accident" is based on actual events—the difficulty of controlling water levels has occurred already in one reactor in the Midwest; the weakness of the pumps is based on a reactor on the East Coast; and there has been a partial melt in the Fermi plant near Detroit.

Three real-life near catastrophes, transformed into one celluloid nightmare. A valid use of documented material, but what are the chances of a real China syndrome occurring?

"It's not a totally impossible event," warns Minor. Consider these statistics. The probability of a core melt is one in 20,000 with an uncertainty of four to five, according to Dr. Norm Rasmassun of MIT, responsible for the Reactor Safety Study, titled WASH 1400. There are 70 licensed plants right now. Minor calculates that if there were 100, then the odds would be one in a 200-year accident rate. Since plants have a life expectancy of 40 years, he speculates that the probability of a core melt during the lifetime of a nuclear power plant is pretty high.

As the movie points out, a core meltdown is only one kind of accident. For example, the scram—the system that is supposed to shut down the nuclear reactor—could fail to function.

"You can't preclude any of the major accidents," cautions Minor. "Things that you think are very low probability can happen and do happen."

Radiation, though, is an ever-present silent danger. In the film, the TV station administrators and the energy honchos take the attitude that what people can't see ought not to worry them. Adding impact to the stance are some pretty incredible re-enactments of nuclear energy hearings, wherein people voice endless, repetitive outrage at an energy solution they don't understand but intuitively fear. What makes these scenes doubly convincing is that they are based on actual transcripts and documentation of hearings.

According to Fonda, the major problem in making *China Syndrome* was rendering a complex scientific problem into a readily understood situation without sacrificing authenticity. The movie was filmed at several power plants but, of course, because of industry opposition none of them were nuclear. The fatal pump, which is seen shimmering and shaking on the verge of collapse, is really a miniature—12 feet high but weighing several tons. All the data and vocabulary are scientifically correct, although various ingredients of different kinds of nuclear reactors have been woven into one. For example, the symptoms of the transient situation are typical of boiling water reactors, while the control room and the containment shots are typical of pressurized water reactors.

Both on and off the screen, adding to plant personnel's worries is the growing fear of sabotage. When *China*'s Godell decides to tell the world about the "accident" he almost mishandled, he unleashes forces that ultimately turn the movie into a gripping thriller.

"The story itself," says director James Bridges, "involves very decent people who are trapped by technology. As each character responds to the same event, we become aware of lives compromised by careers, and perceptions clouded by competition."

Always lingering behind the drama, though, is the unsettling awareness that the energy slated to keep our electric razors humming and our microwave ovens burning can unexpectedly turn on us. Fonda looks to solar energy as one of the solutions of the future. She hopes *China Syndrome* may be one of the catalysts needed to help bring about that transformation.

"We learned a couple of lessons," says Fonda about making films that show a social reality. "As long as the participants share a vision, know what they want to say and have some ability to work collaboratively, and as long as there is a script that is the spinal column of that vision, then you can succeed."

Left: Jane Fonda and bearded Michael Douglas witness an accident at a nuclear power plant and get caught up in a cover-up. The plotline is based on actual incidents.

WAR IN SPACE

Military minds are now cooking up some frightening plans for outer space: high-energy lasers, charged particle beams, nuclear missiles, spies in the sky and soldiers in orbit

Deep in the silent vacuum of space, a U.S. reconnaissance satellite is observing Soviet military forces as they deploy during a crisis. Suddenly, a piercing light blinks on in Soviet Central Asia. A narrow laser beam strikes the American spacecraft, disabling it. Hundreds of miles away in another orbit, a darkened object comes to life and fires a pencil of energy at a Soviet radar satellite surveilling the U.S. Atlantic Fleet, knifing through the electronic innards of the Russian space robot. Laser beams dance across the sky as retaliation follows retaliation, shattering the satellites that hold together the strategic nervous systems of the superpowers. Fearful of going blind as the crisis deepens, commanders on both sides edge toward launching their strategic weapons.

This is not fantasy. It is simply a projection into the future, based on factual reports that appear in aerospace journals. This kind of space war could become a reality within a decade.

In 1975, a U.S. early warning satellite posted over the Indian Ocean was blinded by light from the central USSR. American defense officials feared that the Soviets had used a laser—a powerful beam of coherent light, fired from a complex on the ground. The incident was explained away by blaming it on the glow from natural gas fires in the USSR. But U.S. space planners began taking measures to protect their satellites. Military writers advocated protective hardening, maneuver jets, decoys, alarms that would sound if the satellite were attacked, and "dark" back-up satellites hidden in space. Now the Air Force is working on ways to launch replacement satellites on short notice.

Why this concern about robots in space? Because satellites have become vital to the security of the great powers. They give defense forces superior means for reconnaissance, early warning, communication, and the monitoring of arms control agreements. They are the highest observation posts, the eyes and ears of the modern military machine. A threat to them could endanger peace between the great powers, and invite a new arms race in space.

But military planners face a dilemma. They may need to take out some of the other side's satellites in war because they would be dangerous to our forces. U.S. Secretary of the Navy William Middendorf said in 1976 that the Soviets would use satel-

By STELLA MORRIS

lites to target missiles on U.S. ships, and that "we have got to work like mad" to be able to neutralize those spacecraft. The Soviets made it clear early in the space age that they reserved the right to attack satellites they found threatening, including those which might attempt to beam television signals directly to homes in the USSR.

Early satellites were "above the battle," out of the reach of anti-aircraft weapons. But the U.S. and the USSR soon began testing anti-satellite devices. After Sputnik, the U.S. started work on SAINT, which was to inspect enemy satellites and destroy them if necessary. Later, the U.S. deployed two types of nuclear-tipped anti-satellite rockets on islands in the Pacific. The Soviets have conducted many tests of an interceptor that simply matches orbits with its targets and then explodes.

Some of the ideas that have been proposed for dealing with enemy satellites sound like they came from the science fiction of the 1920s. A Navy program called Early Spring was designed to place a swarm of metal pellets in a satellite's path. Other systems would have sprayed the other satellite's optical windows with paint, or cast a metal net over it, like a Roman gladiator fighting a swordsman. Perhaps the most charming of all anti-satellite acronyms was BAMBI—Ballistic Missile Boost Intercept.

Early in 1976, after a four-year hiatus, the Soviet Union resumed testing of its satellite killer. U.S. officials warned that the U.S. would have to respond by developing its own anti-satellite system. Press reports indicate that the U.S. has accelerated work on a direct-ascent interceptor, a rocket fired up at the enemy satellite from below. Instead of carrying atomic warheads, this system would use infrared sensors to put metal "tomato cans" on a collision course with the target—no mean feat when the satellite is doing 18,000 miles per hour. Appropriately, this approach is called HIT (for Homing Intercept Technology).

Space Forces

Meanwhile, the U.S. and the USSR may be moving toward making the old military dream of a Space Force into reality. The U.S. will begin launching shuttle orbiters into space later this year. While most will be for civil and scientific missions, some will be controlled and used by the U.S. military. The Air Force will have its own launching center at Vandenberg Air Force Base in California.

The Soviets also appear to be developing space shuttles. Reports indicate that they may be trying out more than one model. One, called Kosmolyot, may be a small, one-man delta-winged craft, like a space fighter (shades of X-wings and Colonial Vipers!). The U.S. had planned a similar vehicle, called Dyna-Soar, but the program was canceled in the 1960s. Another Soviet shuttle design reportedly is 200 feet long. The Soviets are said to be working on a first stage that can be flown back to the launching pad, making the whole shuttle system reusable. Like the U.S. shuttle, these "space planes" will be able to maneuver from orbit to orbit, and to carry weapons.

Early in the Space Age, writers argued that space stations would be ideal platforms for weapons, since they look down on Earth. There was much talk of orbital bombs and "global rockets," and the Soviets actually tested an orbiting nuclear missile called FOBS—Fractional Orbital Bombardment System. But it now looks as if ballistic missiles launched from Earth are cheaper and easier to operate.

Strategic missiles could be driven into space by the growing problem of survivability. As each side improves the accuracy of its missiles and increases the number of its warheads, it becomes more able to knock out the deterrent forces of the other side. This makes weapons on the ground —known as ICBMs, or Intercontinental Ballistic Missiles—vulnerable to surprise attack. Nine years ago, aerospace engineer Robert Salkeld argued that the solution was to station nuclear armed missiles and their manned control stations deep in space, where they would be difficult for an enemy to detect and destroy. This would assure that many would survive a surprise attack, and would preserve the balance of terror. But the enemy might deploy weapons in space to knock out *those* missiles in a crisis.

Death Rays

The Outer Space Treaty of 1967 forbids nations to station nuclear weapons in space. But space stations could be ideal platforms for weapons that beam energy, like the death ray of science fiction.

There are two potential types of directed energy weapons. One is the laser, which concentrates intense light into a coherent beam. Lasers are a reality; they can cut through metal. Already, there are reports that experimental U.S. lasers have shot down helicopters and high-speed missiles.

The other type is the particle beam weapon, which would accelerate electrons, protons, heavy ions, or neutrons, and direct them at a target. Retired U.S. Air Force General George Keegan argues that the Soviets have been developing a particle beam weapon and are close to deploying it. The Russian beam weapon, says Keegan, would be used as an anti-ballistic missile (ABM) system, shooting down U.S. warheads in mid-air before they could strike the Soviet Union.

Other experts, such as IBM Chief Scientist Richard Garwin, believe that a particle beam weapon is so difficult technologically that it is not a near-term prospect. For one thing, it would require enormous amounts of energy—perhaps a contained underground nuclear explosion. And aiming the beam accurately is a tough problem.

Lasers and particle beams would be difficult to fire for long distances through the atmosphere, since laser beams spread out and particles collide with atoms in the air (one proposed solution is to combine the two devices, using a laser to bore a "tunnel" through the atmosphere for a particle beam). But directed energy weapons may be perfect in the vacuum of space. There a laser beam will travel in a straight line *at the speed of light,* making it the quickest weapon in history. Scientists already have bounced laser beams off reflectors on the Moon and on artificial satellites. A particle beam also would be a near-light-speed weapon, though Earth's magnetic field would cause the particles to follow a slightly curving path.

The Soviets reportedly have tested a particle beam device from their Salyut space station—the only station operating in space, now that the U.S. Skylab is doomed to fall into the atmosphere. The U.S. has no approved plans for a space station.

How would directed energy weapons be used in space? Ground-based lasers powerful enough to penetrate the atmosphere could shoot up at satellites. A laser "cannon" could be mounted in the payload bay of a space shuttle, if the laser's power source could be reduced in size. Large satellites could be equipped with lasers and left in space, orbiting silently until activated by a command from the ground. This would cross an important threshold; for the first time, weapons would be stationed permanently in space, forever changing its status as a weapons-free sanctuary.

Recent reports indicate that the U.S. Air Force plans to build two high powered anti-satellite lasers, one at White Sands, New Mexico, and the other at China Lake in California's Mojave Desert. The Air Force also is said to be planning a neutral particle beam weapon mounted on a spacecraft.

The Space-Based ABM

Some writers have proposed space-based lasers as ABM weapons. Orbiting Earth, they would look down on the launch areas of the enemy's strategic weapons. They could pick off ICBMs as they rose up out of the atmosphere, breaking them up or fusing their electronics. With enough power, they could penetrate the atmosphere and hit bombers, perhaps even cruise missiles. Since a laser can be fired again and again, one laser ABM weapon could destroy many missiles and bombers. That is, as long as there is enough energy to power the weapons—and military planners are already at work developing compact nuclear generators to furnish power for their space-based weaponry. A fully developed laser ABM system might require soldiers in space for flexible command.

An active defense based on space weapons may sound like a good idea. But it would be a dramatic change from the present situation, in which each side is vulnerable to attack by the other's nuclear warheads. Since U.S. and Soviet ABM systems are limited by a treaty, each side retains the threat of *assured destruction* over the other. This situation of Mutual Assured Destruction (MAD) is what deters both powers from attacking.

If an effective defense against strategic weapons becomes possible, perhaps by de-

(continued on page 65)

H.G. Wells Revival

In his heyday, writer H.G. Wells was considered the king of science fiction visionaries. With the dawning of the age of motion pictures, his spectacular literary works provided fertile ground for cinematic special effects technicians. Starting in the era of silent films, the coupling of Wells and moving imagery resulted in several genre classics; most notably *The War of the Worlds, The Time Machine* and *First Men In The Moon*. Wells himself got into the act during the 1930s, penning the screenplays to *Things To Come* and *The Man Who Could Work Miracles*. When science fiction fell out of favor in Hollywood, so did the works of H.G. Wells. Today, during the great screen science fiction boom, Wells is once again considered fine film fodder. From Canada comes an all new, spacey version of *The Shape of Things To Come*. In *Time After Time*, Wells himself finds his way to the screen, traipsing through time after an escaped Jack the Ripper.

LETTERING BY LINDSAY GREIG-COUCH

H.G. Wells Revival

The Shape of Things To Come

By JOSEPH KAY

The all-new, widescreen version of the Wells classic has replaced sociology with spaceships and righteousness with robotics.

Carol Lynley spends her free time running away from killer robots. Jack Palance spends his free time creating them.

Sparks, a born-again mechanical murderer, spends his free time reciting poetry.

That, in a nutshell, is the state of life-in-the-offing espoused in the forthcoming film, *The Shape of Things To Come*, a non-remake "remake" of H.G. Wells' classic film of four decades ago. In 1936, Wells penned the screenplay to the million dollar drama *Things To Come*. The grandiose glimpse into the future was based upon a book by Wells and peopled by barbaric war-mongers, idealists equipped with peace-gas grenades and a high-flying scientific community of altruists.

In a month or so, an all new *Shape of Things To Come* will be making its way to theaters across the country, bearing futuristic visions slightly different than those proposed by Wells, although closely alligned to those offered recently by *Star Wars* and *Battlestar Galactica*. Gone will be the original film's philosophical tirades, the sociological battles and the monorailed metropolises. Present and accounted for will be fleets of ray gun-firing spaceships, deadly robots, jumpsuited space dwellers and damsels in distress.

"We have admittedly taken certain liberties with the original Wells concept," smiles the new movie's executive producer Harry Alan Towers, "but out of necessity. I don't think anyone will be disappointed."

Towers, a well-seasoned Canadian film producer, says that the new *Shape of Things To Come* is radically different than the original and should not be considered a "re-make" in the strictest sense of the word. "It's a futuristic sequel... of sorts," he states enigmatically.

The entire sequel/re-make began nearly two years ago when, in the midst of *Star Wars* mania, Towers decided to dabble in science fiction. He optioned *Things To Come*, both as a potential multi-million dollar widescreen space opera and a possible TV series. Planned as a joint Canadian/English co-production, Towers then enlisted the aid of a number of top British SF experts, including *Space: 1999*'s Sylvia Anderson, the soon-to-be movie's technical advisor. Later on in the game, the film switched its base of operations exclusively to Canada and the English participants, including Ms. Anderson, were let go. ("No hard feelings," says Towers.) Then the shape of *The Shape* began to mutate.

"It was at that point," the producer recalls, "that we realized it was impossible to remake the original Alexander Korda film. We had a big problem with the script. I had a long talk about it with Frank Wells, the son of H.G. Wells. He's our chief consultant and, well, I think he's a little worried about the storyline we've come up with. But, as I pointed out to him, we were backed into a corner. What can you do with a book that ends years before the actual year you're starting to film in? You've got to elaborate on it and use the original as a springboard.

"The Korda film couldn't be redone because, frankly, it would be out of date. The whole point of the 1936 film was that Armageddon was coming quickly. The movie was written between World Wars and it really starts at the beginning of WW II. It assumes that WW II really spreads into an all-out holocaust and that people get carved up more than they actually did. Out of the mess that's left, a new race begins that takes over the Earth.

"Now, I don't believe that people still think along those lines. Earth has become too small a place for a new race to suddenly come into being. In those days, Wells could write a fable within the confines of a vast world. That world has since dwindled in size and mystery. Everyone knows you can fly around the world in 48 hours. So what? In order to sustain suspense today, you've got to create a bigger threat, you have to go out of this world. Remember, H.G. Wells' vision of the future was conditioned upon what he knew about the *present*. Well, his *present* is our *past*. Today, we have to look forward, envision what we will do tomorrow."

And so a new variation of the Wells tale was born. "We took the premise contained in the original," Towers explains, "that a world of engineers would ultimately arise and create a conflict between those citizens who want to keep the world the way it is and those who want to advance it. We've merely translated that conflict onward into a futuristic era.

"If you recall the first movie, there's a very fine ending scene between Edward Chapman as Passworthy and Raymond Massey as Cabal. As a rocket containing their son and daughter blasts off for the first attempted trip to the Moon, Chapman asks 'Will they return?' Massey looks to the stars and says 'Yes. And go again. And again—until the landing can be made and the Moon

Barry Morse, late of *Space: 1999*, is *The Shape of Things To Come*'s new Caball descendant of the original's Raymond Massey.

is conquered. This is only a beginning.' Chapman wonders if progress will ever end and Massey replies that, for Man, it will never end. It will go on and on.

"We've used those lines in our movie. What we have projected is a situation where those people who went off in that spaceship actually landed on the Moon successfully. Now, two generations later, there is a thriving colony out there. The Moon colonists are a bit like the North Americans of today, looking down on the old world, in a vastly expanded way, of course, because the old world that they look down upon has been racked with robot wars, pollution and disease. It is really a mess down there and a brave new world has been established on the Moon's surface.

"Our lead character is the grandson of the Cabal who went into space at the end of H.G. Wells' film. He gets involved in a good old, fast-moving adventure situation, all springing from the original concept."

In Towers' version, the Moon base of New Washington is attacked by the space ships of renegade robot-master and self-

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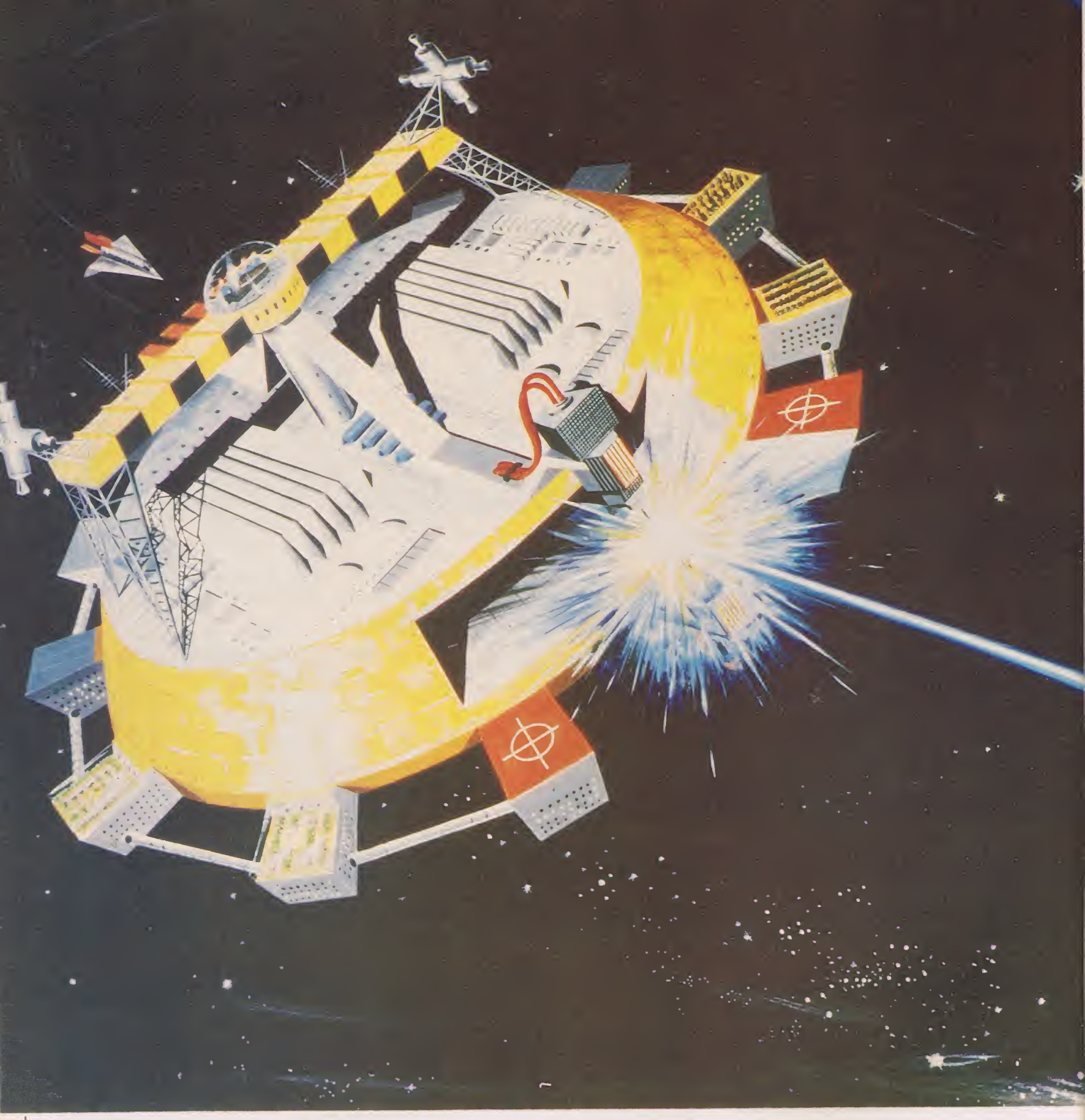
Pre-production art from the new *Shape*, done by British illustrator Reg Hill, depicting a hastily executed landing of a spacecraft.

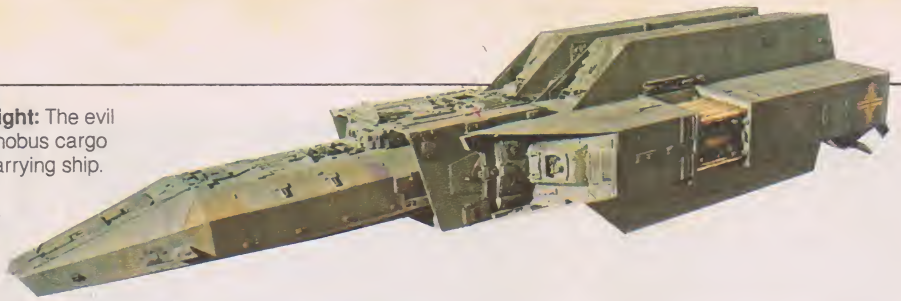


H.G. Wells Revival

styled emperor of the planet Delta III, Omus (Jack Palance). New Washington is given an ultimatum; surrender itself and the Earth or be wiped out. Since New Washington is populated by pacifists, it is ill-prepared to defend itself.

Defying the idealistic efforts of Senator Smedley (John Ireland), a defense attempt is made by Jason Caball (Nicholas Campbell), his father, Dr. John Caball (Barry Morse), robot technician Kim Smedley (Eddie Benton) and a rewired robot "Sparks," a former disciple of Omus now transformed into a poetry buff and fighter for the powers of righteousness. The small army blasts off in the good ship *Starstreak* and heads for Delta III where they plan to KO Omus and rescue Moon-maiden Niki (Carol Lynley) and her fellow human captives from Omus' prison camp. Needless to say, it's one skirmish after another from that point onward.

"I'd be lying if I told you we weren't influenced by *Star Wars*," Towers states candidly, "but then again, *Star Wars* was influenced by dozens of space adventures made in the past. We're very pleased with the results of our efforts. Wally Gentleman, who supervised the effects on *2001*, acts in a



Right: The evil Phobus cargo carrying ship.

Above: Robot Sparks lends a hand at the controls.

Opposite page: Reg Hill artwork depicting an unfilmed battle.

Robot master Omus (Jack Palance) picks up a set of bad vibes as his metallic minions stage an impromptu revolt. Even in the future, good trounces evil.

Senator Smedley (John Ireland) chats with oval Lomax—the central computer—concerning possible means of Omus-proof defense. Smedley is a die-hard pacifist who refuses to do battle with Omus.

similar capacity on this film, working with Don Weed. All the scenes were shot in Canada except the outer space footage, which was done in Hollywood under Gentleman's direction. Brick Price, of *Project UFO*, built the spaceships used. We managed to find quite an excellent effects team. We had a substantial budget (some $3 million plus) but one limited enough that we had to find a creative team capable of getting every penny's worth of effects onto the screen."

Towers is quite ecstatic over the results. "I think Wells would have appreciated our *The Shape of Things To Come*," he beams. "When watching our spaceships zoom across the screen, you really have to think about what H.G. Wells would have written if he was alive today."

With cinematic spaceships zooming and renegade robots zapping, does Towers feel that his somewhat liberal updating of Wellsian theory will offend SF purists? "No, not really. We're referring to the movie as a fable of the future." He pauses thoughtfully for a moment. "There's a little bit of nonsense involved," he chuckles, "but it's still a very nice fable."

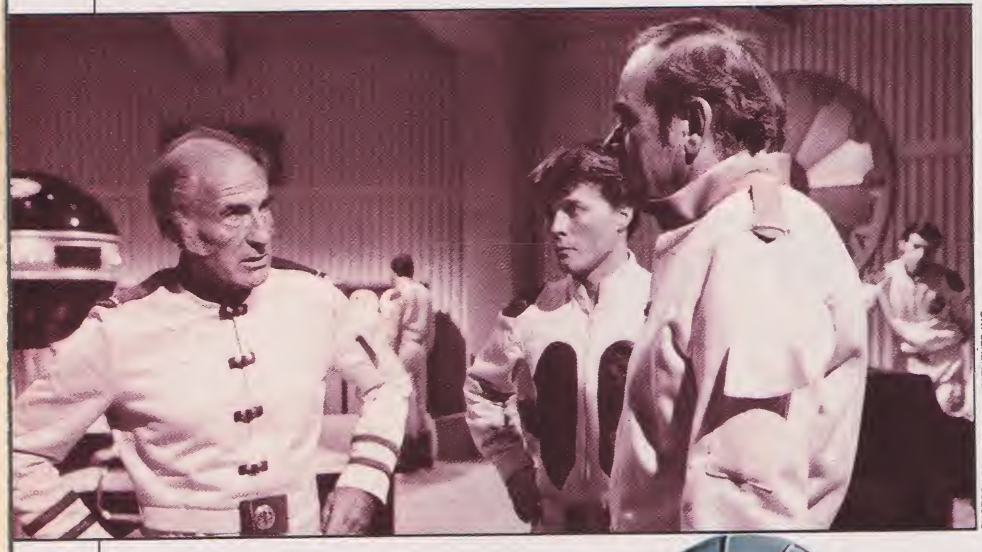
THE SHAPE OF THINGS TO COME

Cast and Credits

An Allied Artists release. 1979. Running time: undetermined. Color. Executive Producer: Harry Alan Towers. Produced by William Davidson. Directed by George McCowan. Screenplay by Martin Lager. Director of Special Effects: Wally Gentleman. Scientific Consultant: Frank Wells. Director of Photography: Reginald Morris. Editor: Stan Cole. Production Manager: Marilyn Stonehouse. Art Direction: Gerry Holmes. Special Effects: Don Weed. Miniature Construction: Brick Price.

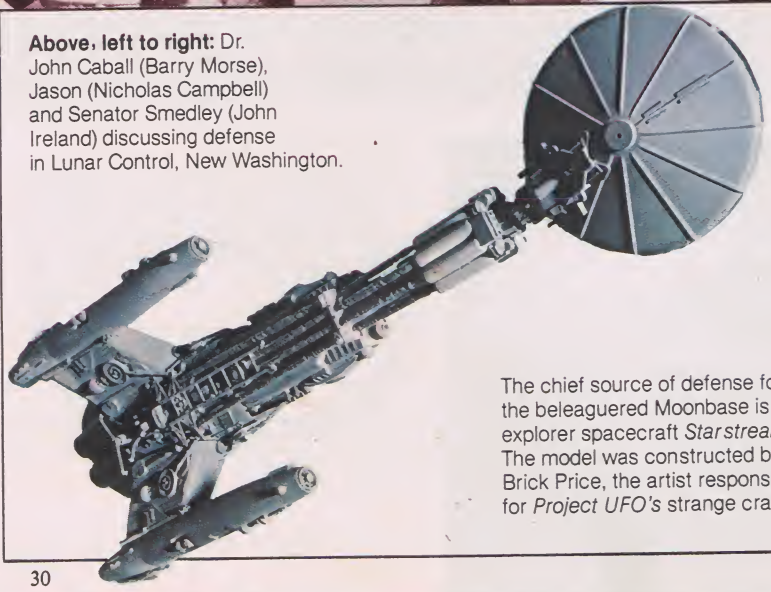
A CFI Investments Inc. Presentation.

Omus . . . . . Jack Palance
Dr. John Caball . . . . . Barry Morse
Niki . . . . . Carol Lynley
Senator Smedley . . . . . John Ireland
Jason Caball . . . . . Nicholas Campbell
Kim Smedley . . . . . Eddie Benton
Sparks . . . . . himself



PHOTOS/ART: © 1979 CFI INVESTMENTS, INC.

Above, left to right: Dr. John Caball (Barry Morse), Jason (Nicholas Campbell) and Senator Smedley (John Ireland) discussing defense in Lunar Control, New Washington.



The chief source of defense for the beleaguered Moonbase is the explorer spacecraft *Starstreak*. The model was constructed by Brick Price, the artist responsible for *Project UFO's* strange craft.

H.G. Wells Revival

Return of the Time Traveler

By BARBARA LEWIS

In "Time After Time", H.G. Wells battles evil world in the future of 1979. After a few days, he finds himself missing the Morlocks.

H. G. Wells is back.

So is Jack the Ripper.

Both characters take part in a helter-skelter journey through cinematic time and space in the upcoming Warner Brothers SF thriller, *Time After Time*. Written and directed by Nicholas (*The Seven Percent Solution*) Meyer, *Time After Time* is an admittted oddity in today's multi-million dollar SF epic market. It's modestly budgeted at $4 million. It meshes fact with fiction, thrusting author Wells into the role of time traveler. It combines elements of science fiction, social commentary and satire. Thus far, it has attracted little or no attention from the media.

"It's a strange little story," admits Meyer, "with unlimited possibilities." The idea for the film itself is based on a novel, *The Time Travelers*, by Meyer's college friend, Karl Alexander. Alexander, it seems, was inspired to write the book after reading Meyer's Sherlock Holmes adventure, *The Seven Percent Solution*.

The story begins in London, 1893, where Wells is about to unveil his time traveling invention to a group of friends, among them

his chess partner, Dr. Henry Stevenson. There is a knock on the door and the police enter Wells' home, stating that a prostitute has been murdered nearby and they are in pursuit of the perpetrator—Jack the Ripper. When bloody gloves and a scalpel are uncovered in Stevenson's medical bag, it becomes apparent that he is the culprit.

During the search, however, Stevenson makes his way to Wells' machine and transports himself to 1979... winding up in a San Francisco museum where the time machine is displayed as part of a Wellsian exhibit. Wells, who had built the machine to carry him into a Utopian future, is distraught at having his invention used as an escape vehicle for a murdering fiend. Thanks to a safety feature, the machine returns to Wells' lab, showing Stevenson's date of departure.

Wells pursues Jack the Ripper into the distant futureworld of '79, accompanied by Amy Robbins, a Bank of London employee, and ultimately, Wells' true love. When they finally locate the Ripper in San Francisco, Amy is unexpectedly cornered by Dr. Stevenson. Using all the powers at his disposal, Wells attempts to rescue his heart-throb...only to be caught up in 1979's fairly unromanticized concept of law and order.

On a crisp California day, Meyer attempts to film this clash of ideals with as little ballyhoo as possible. His director's chair sits plunk in the middle of a sidewalk in the posh Pacific Heights area of San Francisco —just a fog horn's blast from the Golden Gate Bridge. Meyer doesn't have time to sit on his canvas throne, nor does he help himself to coffee and donuts from a makeshift stand quickly put together to keep the cast and crew of *Time After Time* fed between takes.

The scene is crucial. Apparently, Meyer is the only one taking stock of that fact. Heavy-duty electric wires are casually draped across the lawn of the Palace of Fine Arts where the day's shooting is set. Children with balloons regard the wires with caution but nearby frisbee tossers go about their business, oblivious to the fact that a film is being made in their midst.

Frankly, no one seems to pay much attention to the goings on as two centuries meet head on under the kleig lights. Every now and then a passing motorist does a double take as movie police sirens wail. The startled drivers slow down, only to be waved on by a group of fake cops who, in this scene, are after Wells.

As the cameras roll, Malcolm McDowell as Wells is dragged from a house by two policemen, kicking and screaming for Amy Robbins to flee before she is murdered by Jack the Ripper. The cops, thinking Wells a raving maniac, shove him roughly into a squad car, turn on the flashing lights and speed off, with McDowell continuing to shout through the windows of the vehicle.

Malcolm McDowell is H.G. Wells in *Time After Time*. Above, a startled Wells finds himself in San Francisco in 1979 at a museum exposition held in his honor.

At an indoor Wells exhibit, the very much alive author comes across his time machine in the midst of a veddy Victorian display. Both Wells and Jack the Ripper have used the device to travel far into the future: 1979.

Meyer yells "cut" and the police car returns to its starting point. McDowell climbs out of the car, his face beet red from the struggle. He looks at Meyer for approval. "You were great," the director smiles. "But I want to try it again."

McDowell re-enters the house and once again is dragged out, yelling and kicking for dear life. The second, third and fourth takes are just as convincing (and exhausting) as the first. Between takes McDowell steps out of the squad car, but never out of character, and catches his breath while slumped in Meyer's director's chair. It's a unique part for McDowell, perhaps best known for his starring role in Kubrick's *A Clockwork Orange*, and he does his best to remain the essence of Wells on and off camera.

Meyer seems happy with the day's shooting so far, pleased with the level of professionalism displayed by his cast. Amy is portrayed by Mary Steenburgen in her first role since debuting onscreen in Jack Nicholson's *Goin' South*. David Warner is the evil Stevenson/Ripper.

Also starring in the film is the Time Machine itself—as concocted by Meyer. It is constructed of fiberglass on a metal frame and "powered" by solar energy. Even though the Time Machine is, according to the story, built in 1893, its solar power is historically justified, according to Meyer. As early as 1882, he states, a French engineer named Abel Pifre created a working printing press powered by solar energy.

Meyer supervises work on the set and nods in approval. He has fashioned the story into a five-pronged project, he states. He considers it a science fiction film, a romance, a comedy, a thriller and an exercise in social commentary.

"There's a bit of everything in here," he smiles. "Imagine how Wells feels when he corners the Ripper in 1979, only to find that, in the future, violence can be seen daily on the six o'clock news. A fiend from Wells' own time becomes just another killer in the future. All along, Wells has believed that his machine had unleashed a maniac upon a Utopian society."

As Meyer finishes speaking, the action on the set resumes. Wells vs. the Ripper. The Ripper vs. the city of San Francisco. Good vs. evil...time after time after time.

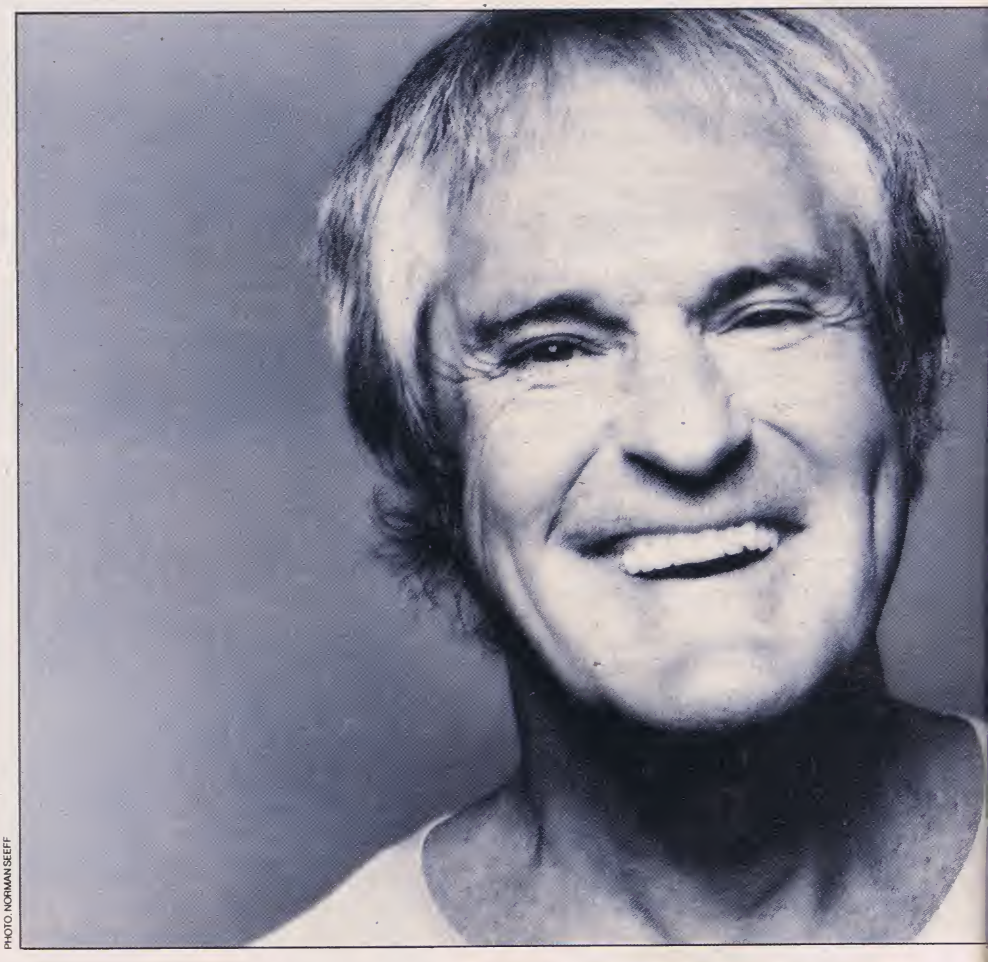
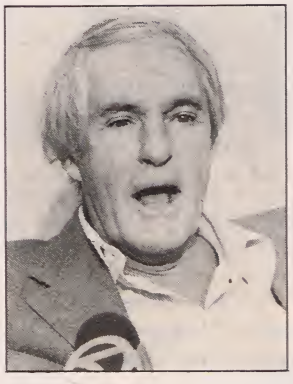
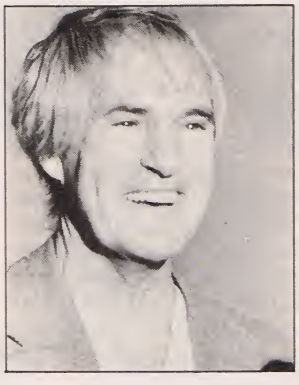


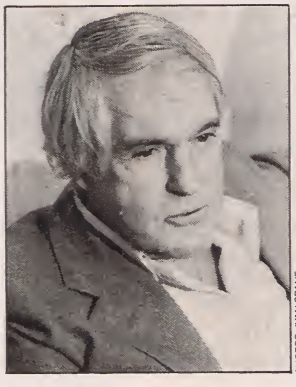
PHOTO: NORMAN SEEFF



"Egg wisdom does not play dice with the universe. Evolution is right on schedule, failsafe, foolproof, perfect."



"It should come as no suprise to you that I'm talking about living in space...you know I've always been an enemy of gravity..."



PHOTOS: IVAN SPANE

"Young people today don't know much about space colonization, but they're really 'spaced-out.' Just watch TV..."

"On the North American continent, literally new species are popping out of wombs with nervous systems as far removed from their parents as their parents are removed from the cave dwellers."

INTERVIEW

Timothy Leary

By ROBIN SNELSON

Now appearing at colleges and universities, on TV talk shows and in other places of enlightenment across the land — Timothy Leary; the chief spokesman for the 1960s psychedelia. Audiences who expect to hear reminiscences of the counter culture from the former High Priest of LSD, however, are in for quite a surprise.

Dr. Leary's oft-quoted message for the 60s, "tune in, turn on, drop out," has been superseded by his instructions for the 80s: Space Migration, Intelligence Increase and Life Extension—expressed by the cheerful acronym, S.M.I².L.E.

His recent books*, in addition to containing fascinating and playfully written autobiographical vignettes from his highly eventful life, are filled with radical, thought-provoking futuristic philosophy. Leary enthusiastically tackles the future not many dare to predict—that of the human species.

His appearances are charged with energy. His incredible intelligence is softened by his flair for the comic and his personal charisma. And he's saying some very interesting things.

In case you haven't had the opportunity to hear what Timothy Leary is pushing these days, FUTURE LIFE took an electronic recording device to a recent mutational ceremony held at Stony Brook University on Long Island, New York. A portion of that transmission is reproduced here, in a painfully condensed version which includes an interview conducted in transit from Manhattan to Stony Brook.

"I am practicing a profession that's somewhat controversial and confusing," he says by way of introduction. "It will not be listed in the yellow pages of your phone book until the 21st century. It will be called then Evolutionary Agent. Today, and in the past, the profession which I practice has been called philosopher."

His eyes light up with characteristic humor. "I've got to admit to you right now that I'm a robot. I'm completely genetically templated, wound up and shoved back into the 20th century to play a role that's needed in every gene pool. I'm a programmed automaton and it's my job to come out here and use this electronic magnification to send signals to your eardrums which are passed on to your nervous systems and then on to your DNA and RNA, activating those who are ready to be activated to higher levels of consciousness."

He smiles. "So it's just a simple, straightforward, mutational ceremony we're holding here tonight."

In the last year and a half, Timothy Leary has been to 48 of the 50 states, "practicing this oral tradition of intelligence agent who comes before you, coming from village to village and town to town, trying to activate nervous systems to change.

"The problem with this job," he confides, "is that the adult authorities don't generally want you to come around listening to people who are going to tell you how you change. The trick is to move fast. You try to get into 90 minutes more information, more survival electricity, more jazzed-up mutational futational energy than has ever been given before in 90 minutes. . . then you get your ass out of town fast before the adult authorities realize what's happened."

*(*Neuropolitics* and *Exo-Psychology*, 1977, and *What Does Woman Want?*, 1976, from Peace Press. *Intelligence Agents*, described as a magazine written in the future, about evolution, is to be published in the fall.)

"If you want to increase your intelligence, move. If you want to get smarter, move. For 4,000 years, the smartest human beings on this planet have realized that you can stay and fight or you can move."

To get things started, he announces, "I'm going to kick ass with Darwinian theory." Evolution, according to Leary, is not the haphazard result of millennia of mistakes. There *is* a higher intelligence operating and his name for it is "egg wisdom."

"Egg wisdom does not play dice with the universe," he contends. "She knows exactly what she's doing and evolution is proceeding right on schedule, failsafe, foolproof, perfect."

He delivers his "commercial for egg wisdom" in a hushed, reverent tone. "Every woman carries in her body *one million eggs*, of which roughly 400 to 800 are selected to drop down the fallopian tubes during the fertile years of her life. *The selection of those eggs is not random or chance.* Among the eggs is an enormous variety of time-defined nervous systems; DNA-RNA models to create the neuromuscular technologies needed for survival in different ecological niches. In any gene pool there is an inter-woman biochemical language, a precise intelligence which determines how many paleoliths and how many 21st century and 22nd century nervous systems are needed.

"Egg wisdom and DNA operate with large geographical gene pools over long periods of time. But in the final analysis, evolution happens with individual nervous systems. We are now becoming smart enough and virtuous enough as a species, and we understand the relationship between DNA and RNA well enough, to take control of our own personal evolution as individual members of the species.

"The issue of who comes down those fallopian tubes is the single most volatile, most controversial issue today."

By his interpretation of cultural and technological signals—including the dawn of the space age, mass consumerism (a great advance, he says, giving more and more power to the individual) and increasing attention to "self"—Leary divines that evolution is speeding up.

"We are going through a period of accelerated evolution which is probably equal to the moment in history when we first left the water and became terrestrial creatures."

His analysis of what happened in this country in the 1960s supports that thesis. "We've just gone through a pedamorphic neotenist rejection of the over-specialized dinosaur adult known as the human race."

(Pedamorphosis, he explains, is a concept from evolutionary theory which holds that the only time an individual of a species can mutate is in the pre-adult stage. Neoteny refers to reaching sexual maturity in the pre-adult stage or retaining "larval" characteristics in the adult stage.)

In the 60s, Leary says, Bob Dylan, Mick Jagger and The Beatles were singing the songs of pedamorphosis. " 'I ain't gonna work for Maggie's maaaaaa no more.' " he quotes Dylan in an exaggerated imitation. " 'I can't get no satisfaction.' And 'She's leaving home, what did we do wrong?'

"Well, she's leaving home, Mr. and Mrs. Adult, because it's time for the species to mutate!"

After a period of neotenist youth revolt, Leary says Evolutionary Agents are out of their minds with joy. "This is the time Evolutionary Agents love to be around. There's an incredible resurgence of experimentation and new self-identification. Thousands of flowers are blossoming in different directions.

"Right now egg wisdom is dropping more and more advance-model nervous systems down the fallopian tubes. If there were an ice age coming, she'd drop down furrier models. Because evolution is accelerating, she's dropping down more and more futant nervous systems.

"Egg intelligence has not produced many futant nervous systems in the past simply because they'd be wasted," he explains. "If you're back in the Middle East right now, you're not going to produce any futants because survival there requires warriors, neoliths. It is only in times of great technological affluence, and it is only a very successful race/country/tribe that starts producing a significant number of futant nervous systems."

Mutants, or futants, as Leary prefers to call them, are among us now. "On the North American continent, particularly in the Sun Belt, literally new species are popping out of wombs with nervous systems as far removed from their parents as their parents are removed from the cave dwellers."

What makes them so different? "They're totally equipped to deal with neuro-electric reality, dialing and tuning channels. The range of communication techniques available to the ten-year-old American consumer today—record albums, tapes, CB radios, telephones, television, radio, home movies—all this signals a quantum leap in evolution. The key is the young person's ability to move and to communicate. They're ultimate consumers, tremendously self-confident, self-indulgent, learning how to be self-actualized. They're totally cynical and amusedly tolerant of the terminal adults who are running things. They are beautifully alienated.

"Alienation is the most wonderful word in the English language," he says. "You know, terminal adult psychologists would have you feel you're in trouble if you're alienated from your culture. If you're alienated from the Topeka, Kansas, hive—god bless you! You're on the way. And you literally are an alien intelligence."

He takes this observation a step further. "The major thing that will happen in the future—and FUTURE LIFE can have a scoop on this—is pedamorphic or neotenist youth revolt. You're going to see political organizations of kids between the ages of seven and seventeen demanding that they get the vote, that they be allowed to own property and perform business functions. The fact that this demographic group is getting more and more consumer power and getting more sophisticated in their use of so-called adult privileges—sex, drugs, money, communication and transportation techniques—is a powerful activator of an evolutionary jump."

He stresses the concept of pedamorphosis. "We know it is true that the human species is an embryonic form," he points out. "We aren't descended from adult apes, but from intelligent, dropped-out teenage apes who looked at the ape trip and said, 'No way, Jose!'

"If you were in charge of evolution and you wanted it to move fast, what would you do? You'd pick out a species and keep them young as long as you could. The sexually active pre-adult stage of the human being can be stretched and stretched, but in most countries today kids have to go to work in the fields and sweatshops and they are forced into early adulthood. That's the way it's always been.

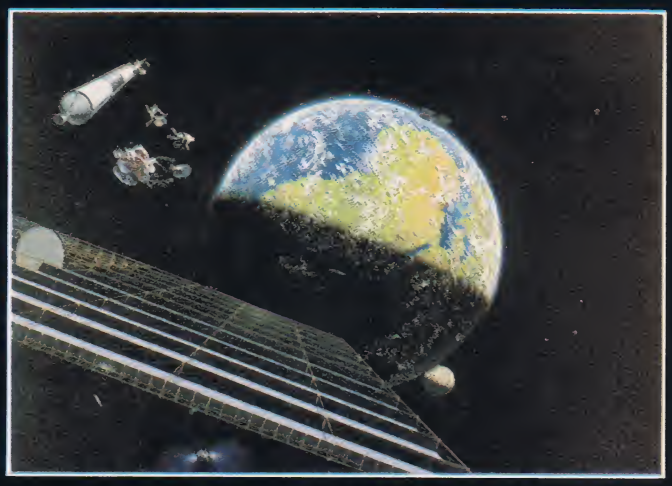
"Recently there's been an incredible upsurge in the youth culture in this country. For example, before World War II not everybody went to college—just the east coast rich kids and the brilliant students.

"Now, you know and I know," he tells the Stony Brook students, "that you don't learn anything at a university like this. It is

(continued on page 66)

GALLERY

Don Davis



In addition to appearing as the featured artist in this installment of Future Gallery, Don Davis' famous space colony paintings also appear on the cover of this issue, and within the article by Gerard K. O'Neill, "Building the First Space Colony." Davis' space colony renderings, commissioned by NASA, have appeared in countless magazines and publications since O'Neill's space habitat concept first became a hot topic. More often than not, however, the artwork is credited only to NASA. If you've been wondering who the artist is, meet Don Davis.

The 26-year-old unabashed space fan hasn't missed a space flight since the morning launches of the early 1960s. He's worked for the U.S. Geological Survey's Branch of Astro-Geological Studies, doing painstakingly accurate renditions of the lunar and Martian surfaces, and he's an avid student of astronomy and planetary science. Although he's never received any formal art training, Davis has had the good fortune of meeting master space artist Chesley Bonestell.

"Bonestell naturally has been a major artistic influence on my work," says Davis, "but my actual input of knowledge from him was not as extensive as some accounts have suggested. Examining one of his original paintings closely provided me at least as much information as I got during the fortunate hours I was able to spend with him during my visits to his studio."

Davis-scapes have appeared in publications ranging from *Sky and Telescope* to *Saturday Review*, but his most widely distributed paintings are those on the cover of Carl Sagan's *Dragons of Eden* and on the interior record sleeve and labels of the Jefferson Starship record, *Earth*. A book exclusively devoted to his art is scheduled to be published later this year by Peacock Press/Bantam.

On this page is the latest book cover by Davis, this one for *Doomsday Has Been Cancelled* by J. Peter Vajk, a new release from Peace Press. Vajk's thesis is that when we factor in the endless frontier and boundless resources of space, current limits-to-growth doomsday scenarios are no longer valid. Here Davis depicts a solar power satellite in close-up, just before it's jockeyed up to geosynchronous orbit by the tugs and multi-armed handling machines also pictured. Above is Earth in the year 2040, with nearly 10 billion people living in large cities. Energy from space helps to light their cities, which Davis says will be an order of magnitude brighter than today.

On the centerspread, Davis' unique view of the planet Saturn as seen from its largest and most dynamic satellite, Titan. He explains the vision: "We are cruising at a high altitude and a faint ice crystal halo surrounds the Sun. Our wide angle perspective allows us a 100-degree field of view, horizontal (most other artists use the 'telephoto effect' when they paint this scene). Saturn and its other satellites are strung across the sky. An opaque deck of clouds drifts over an icy plain buried in ground fog. Observational evidence suggests that the upper deck of clouds is, in fact, broken, allowing other highly reflective surfaces (ice? clouds?) to show through. The cloud deck is orangish to begin with, but the rising Sun accentuates the ruddy coloration. Along with the rays fanning down to the surface below, the bluish cloud shadow areas hint at the extreme cold out here in the outer Solar System."

Centerspread: "Cruising Over Titan" © 1979 Don Davis ⟶

The 23rd Century: A Vision For Star Trek

By JESCO VON PUTTKAMER

ART: LARRY ORTIZ

A picture of the future imagined by a space agency future-planner who also happens to be the science advisor for the forthcoming "Star Trek—The Motion Picture."

About three years ago, *Star Trek*'s creator Gene Roddenberry called me up and requested a vision.

At that time, Roddenberry had begun to develop early plans and script ideas for what was to become Paramount's opulent production of *Star Trek—The Motion Picture.* He made it quite clear that the picture was to remain true to *Star Trek*'s world of an open, glorious future for humanity, and he asked me to serve as Science Advisor on the fascinating project.

Now, he was on the telephone from California, asking me bluntly: "Jes, what will the world of the 23rd century be like? And how will we get there?"

Creating images of the future is the traditional bread-and-butter of science fiction writers. But not exclusively so. The National Aeronautics and Space Administration (NASA) has also used images and scenarios of the future in its studies, planning and public information programs. Creating future scenarios is part of my job with NASA. We try to portray the future not in terms of what *will* be, but what *could* be. Unlike the more free-wheeling imagery of popular literature, NASA scenarios should be reasonably disciplined and should relate to serious social and political issues. Usually, such scenarios do not extend more than 20 or 30 years into the future—at the very most 50 years.

And here was Roddenberry on the horn, asking for a "thumbnail sketch" of the next *250* years!

Okay, I said, I'll see what we can come up with. I'll conjure a vision of a future you'll like. Of all possible futures, it also happens to be my favorite one. But with a personal view like this, of course, scientific rigor and discipline have got to go out the window for the moment, if you please.

What will the world 250 years from now be like? And how will we get there from here?

In a long-range extrapolation from where we stand today, I see us headed toward what I call the Humanization of Space: in the near term, bringing space down to Earth in the service of humanity's needs; in the longer term, a large-scale human migration into space as an evolutionary process.

The key is space industrialization. In our long-range drive to humanize space and achieve space settlement, the industrialization of space can offer a realistic approach to developing a progressive program which provides permanent, practical and commercial utilization of space through products and services that create new values, jobs and better quality of life for all people.

Moreover, the industrialization of space will doubtless lead into space colonization as self-sufficiency in space increases. By being basically non-elitist, Space Industrialization will thus introduce the true humanization of space.

Over the next 200 years, our present exponential population growth will slow down and reach low or zero rates. Thus, the population curve assumes the shape of an "S", rather than going exponential-asymptotic, i.e.: out of bounds. World population will be 15 billion people (about four times today's number), earning an average of $20,000 per capita, with a Gross World Product of about $300 trillion. In other words, an average person in the year 2179 will be 40 to 50 times richer than his or her counterpart today.

When the growth curve begins to level off, about 100 years from now, there could be half a million people living in Earth-Moon (geolunar) space, visited by something like 300,000 Earth tourists per year. As the cost of transportation from Earth to orbit comes down, space tourism on a very large scale will become inevitable, and the age of the Geolunar Civilization will have arrived.

At that time, a "new frontier," the solar system, will open and colonization of heliocentric space will begin. With it, a new S-shaped growth curve will start, topping out at an immensely high population number (care to guess?) when the job of settling the solar system is basically finished and technology again bumps into the limits of its capabilities.

But during that time, major technological breakthroughs will have occurred. The greatest weakness of imagining future scenarios is our inability to predict the effects of unforeseen breakthroughs. We know only one thing from experience: breakthroughs *will* happen.

In my scenario, three major breakthroughs are boldly postulated. The first will be in bio-genetic engineering and gerontology, the scientific study of aging and dying. Aging is not inevitable, and life extension will become possible. As we move toward the 23rd Century, considerable advancements in longevity will at least double the human lifespan and eradicate senility, while the search for the long-suspected but quite elusive "death hormone" in the animal body continues, with immortality the ultimate goal. With increased lifespans, people will be able to change careers several times in their lives, and their greatly extended personal time horizons will no doubt cause them to take greater interest in the future and in space.

The second breakthrough will be a major cultural event: first contact with an extraterrestrial civilization, in the form of unquestionably intelligent radio signals picked up by a large SETI installation on the backside of the Moon. This will herald the beginning of the Age of Maturity for our species.

The third breakthrough will be in the propulsion area. Along with quantum jumps in longevity and extraterrestrial communication, the sudden discovery of a yet-unknown principle (perhaps one involving control of gravitation and other tricks of applied quantum mechanics) will make interstellar travel possible.

The synergistic effect of these three breakthroughs will provide the Solar Civilization with yet another "new frontier": interstellar space. The task of colonizing interstellar space will go on for a long, long time—on the order of ten millennia or so. During these mind-boggling eons, the old S-curve growth of humankind, with the traditional outside pressures and "limits to growth" constraints removed, may indeed change to a truly exponential growth.

What can we say about the peoples and technologies of that future? How will people use technology? Or will technology use people?

I think the perspective that humans 200 years from now will have of the universe and themselves will be radically different from our perspective. Humans of the 23rd Century will likely be of much greater sanity and maturity than today's people. But with maturity also comes the desire for greater humanity or human-ness. Being more mature, they know *who* they are, *what* their place in the universe is and *what it could be.* They know *how* to deal rationally with their resources, energy, wastes, environmental interactions and interpersonal relations. They deeply enjoy making use of all of their senses, and they apply high standards of an ethics beyond ours to everything they are doing. Above all, in following this lifestyle, they have become masters of their destiny

and no longer see themselves as victims of outside forces.

In that world of "ideal" people, technology is carefully selected for its ability to give humans greater humanity *despite* the vastly greater world they inhabit and tasks they face. Technology will be a servant to man, allowing him to develop his human values to unprecedented heights, while at the same time enabling him to deal successfully with vastly greater challenges.

Many people today are disappointed with technology. Others feel that it may even endanger man's prospects. In the film *2001: A Space Odyssey,* technology was shown as a deadly enemy of man when the ship's computer HAL went berserk. In addition, instead of coming across as fully developed "human" humans, those coldly sophisticated and blasé space explorers in *2001* seemed rather stunted in their total development. Is *this* how we want to be?

The world in my scenario for *Star Trek* is a joyous, virile world of new horizons in which technology, as our friendly servant, allows us continued growth, both humanistically and materialistically, both spiritually and physically.

What will life on Earth be like in the 23rd century?

It's likely that there will be something like a dichotomy of two societies living in harmony, but in contrast: a very dynamic, ever-expanding frontier society in outer space, with starships, settlers, space industries, etc., and a relatively static, slowly changing, rather idyllic pastoral society on Earth, comparably unexciting and devoid of adventure except for sports, arts and rituals. Cities and nations with their cultural backgrounds still exist, and the diverse ethnic groups have maintained and cultivated their identities. But issues involving global and space interests are coordinated by a world government, aided by worldwide library and data centers endowed with artificial intelligence.

While in outer space we encounter bustling activist types, eager to take on new challenges, the home planet has been turned—thanks to technology—into a vacationland, drawing unlimited energy from geothermal sources, solar irradiation, and non-radioactive nuclear fusion plants (perhaps using the advanced proton-boron-11 reaction). Food production through conventional agriculture has increased 100-fold, enough to maintain world-wide consumption standards much higher than those in the U.S. today. Most mineral resources of the world have proven close to inexhaustible, including over 99 percent of our important industrial metals. The remaining demand for non-renewable resources is met by recycling and importation of extraterrestrial materials.

Green hills and forests are back, as are clean rivers and crystal-clear skies. Wildlife is abundant, with all formerly endangered species back in business, including the great whales, eagles and wolves. Even many species that had formerly been thought extinct have reappeared. In the world of flora and fauna, genetics and bio-engineering have remedied many of man's past mistakes. Free inter-species communication with higher animals by word, sign language or electronic aids is commonplace, specifically with champanzees, gorillas and dolphins. A global Bill of Animal Rights was instituted in the early 21st century.

Main income of Earth's sedate population comes from tourist industry, operation of top-quality educational centers, and export of knowledge, skills, gourmet foods and special artifacts of historical and sentimental value to wherever Earth folks live.

How about more mundane technologies —such everyday items of technology as bathing, food, and clothing?

There are differences between the technologies used in the "frontier" society and those used on Earth, but all of them enable people to be more "human" than today. (For example, the human body will always require and relish water; thus, in this scenario my bet is that radiation-type baths, while attractive gimmickry, will not be used except in cases where you want to kill off microflora on the skin for quarantine or other reasons.) For cleanliness, people will have portable showers. It strikes me as wasteful and rather silly in a resource-conscious world to construct solid shower stalls that are never used for more than a few minutes a day.

People will simply don a wet-suit-like collapsible enclosure shaped along their body contours and connect it to the nearest power and water wall outlet/inlet. (In a world dedicated to total recycling, wherever there is an outlet for something, there must also be an inlet.) Inside this enclosure, special circulation channels, pumps and heaters give you a most enjoyable and efficient shower and rub-down. After a short blast of warm air to dry both yourself *and* the shower, the enclosure is doffed and stowed away. There is an entire industry for "shower suits," with new models by famous designers every year and fashion shows held on the interplanetary holographic video network.

Bathing and showering for pleasure is something entirely different. Large beautifully landscaped saunas are used for this purpose. By means of technology, including force fields and new discoveries in cloud microphysics, showers can be enjoyed in a natural setting. On activation of a control button, an artificial cloud is formed overhead which provides a genuine cloudburst, tropical rainfall, drenching monsoon, misty morning drizzle, cat-and-dog soaker or soft spring rain.

Bathing and showering in the weightlessness of space will be particularly popular. Floating in clouds of warm fog is the closest people have come to simulating the experience of the unborn baby in the womb.

As for food, my thesis is that the human body will be able to live on synthetic (recycled and reconstituted) food but will always live healthier and longer on naturally grown food. On the other hand, through advances in exo-agriculture and exoponics as well as bio-genetics, people will grow better food stuffs: more energy content and less waste products per unit mass, with new and exotic flavors. With advances in plant and animal genetics, there will be continuous experimentation with new "natural" foods, maybe even cultural and industrial competition in developing "bestsellers"—with appropriate commercials on TV. The two societies may use different classes or qualities of food.

The same distinction between Earth and space-faring lifestyle will apply to clothing. Style and material of space uniforms and working clothes will be functional and professional, suited to the occupation of the wearer.

For all we know, there may be very new types of clothing in that world of the future. Rather than using the really archaic, bothersome clothing that we are accustomed to, requiring change, cleaning, pressing, mending, tailoring, buttoning, zippering, and so on, future folks will have non-reusable clothing that is recycled after each use through total breakdown into its constituent elements by that great innovation of the future: the Fusion Torch.

Even better, many future people will carry nothing but a belt. But what a belt!

This small device contains a rechargeable power source, a tiny microprocessor/computer, a force field generator, and a selector keyboard that allows almost infinite settings. By punching up coded combinations, the power belt wearer dresses by establishing fabrics of force fields around his or her body: selectively skintight or flowing, opaque or transparent, any desired texture, cut, fashion, size, shape, color and hue. The garment never needs cleaning, and its wearer can get undressed at the push of a button (no mess of discarded clothes), has no recycling problem, and can change attire at the flick of a finger. Of course, a safety switch protects against accidental exposure (and practical jokes aimed at attractive wearers). On the other hand, seduction intentions will never again be frustrated by stuck zippers or lengthy disrobings.

With power belts like this, it will be quite a widespread custom (are you ready?) for office girls to change from office attire to after-work topless by pressing a button, in order to signal that they are going off duty. (For office boys, other and even stranger customs will prevail.) Naturally there will be —very humanly—a flourishing fashion industry selling pushbutton code combinations for new and popular styles.

So there you have it, Gene Roddenberry: a future envisioned for *Star Trek—The Motion Picture*...and my favorite 23rd century.

By CAROLYN HENSON

How to meet space entrepreneurs

Do you want to meet future billionaire space moguls? Right now there are people laying the groundwork for off-planet enterprises which will stagger the imagination—and heap money into the pockets of people who invest early. As I mentioned in FUTURE LIFE last time, because of Securities and Exchange Commission regulations I can't tell you everything I know. But there is a way to find out about seminal space entrepreneurs that is both fun and legal. On your next vacation, go to an aerospace conference!

What? And listen to all those boring papers on "Heat Stress Considerations of the Vebelfetzer" and "Numerical Analysis of Verbisbode Calculations?" Hey, don't worry, I said this will be *fun*. Lots of people don't attend any of the sessions where technical papers are read. They know where the *real* action is: in the hotel's bar.

For example, you could hang out at the bar of the Nassau Inn May 14 through 17. The Princeton Space Manufacturing Conference, hosted by chief space colony proponent Gerard K. O'Neill, will be in progress then. The Nassau Inn, located in front of Princeton University's main gate, is where all the insiders hang out. (If you insist on actually attending the conference itself, you can get in free to the Thursday morning summary session. It starts at 9 a.m. in the Woodrow Wilson building. If you get a kick out of the really deep technical stuff and have money to burn—$100 registration fee—write to William O'Brien, Princeton University, Conference Office, 5 Ivy Lane, Princeton, N.J. 08540. Send your name and address and he'll send a conference program and registration materials.)

We future space moguls will be hanging out at the Nassau Inn bar all week, and even if you don't intend to invest a cent in one of our schemes, just meeting us is an adventure of its own. There's the guy in the Starfleet Academy uniform peddling space condominiums, and the wizened little man who claims to have a reactionless drive in the trunk of his car. These guys trumpet their sure-fire investments—no way you can get burned on their fabulous deals—and that's the tipoff that they aren't for real. The folks who have a good chance of making themselves and their investors into millionaires will be modest and unassuming. You will be able to spot them because they will be singing Tom Lehrer songs ("Poisoning the Pigeons in the Park", "The Periodic Table" and other classics), breastfeeding babies and—this is the important part—freely admitting to to the risks of their projects.

If all goes well with the SEC (those Klingons of the business world), Chris Basler will be in that fabled bar. He's president of International Satellite Industries (ISI), a corporation which plans to build solar power satellites. Get out a piece of paper and write ISI on it. Now write it again with the two Is crowding the S. Next drawn an S and write the two Is on top of it and you'll get a dollar sign. You say you want to meet Chris? He's tall, handsome, charming (and unmarried) and will be surrounded by a crowd of young ladies.

While you're hunting for future billionaire space moguls you'll have a good chance of encountering famed space colony researchers. There's the nearly undisputed foremost researcher and host of the conference, Professor Gerard K. O'Neill. You'll spot him instantly because he looks like Leonard Nimoy and acts like Mr. Spock. Speaking of aliens, there's the fellow who disputes O'Neill's leadership, Dr. T.A. Heppenheimer. He is best described as a cross between R2-D2 and Harpo Marx. "Hep" will almost surely treat you to a display which will enable O'Neill to demonstrate that he is indeed as unflappable as Spock.

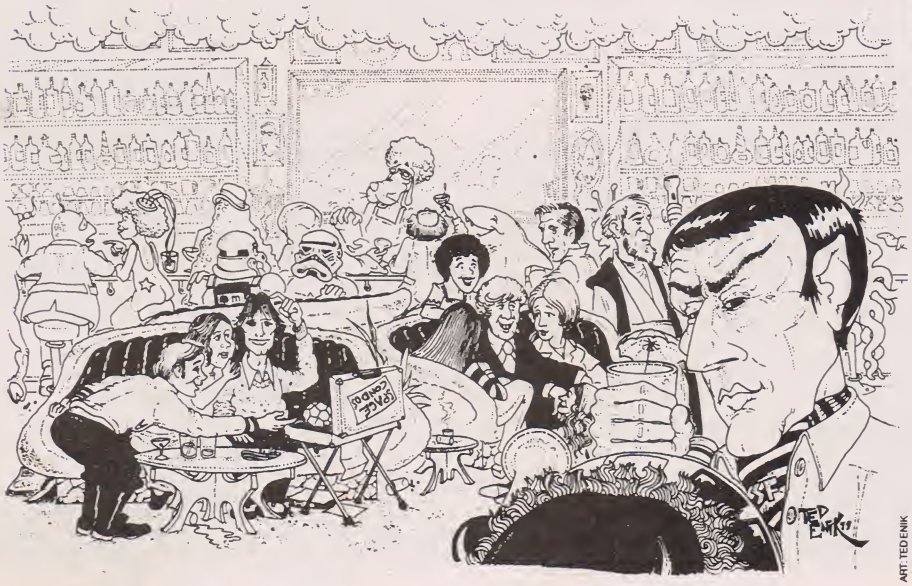
Heppenheimer wrote *Colonies in Space*, however, which is without doubt the best book on the subject. He is currently working on *The Colonists*, which Stackpole Books plans to release soon.

Who else are you likely to meet in the Nassau bar? There's Eric Drexler, one of the nation's most promising space researchers. He looks like the star of *Gilligan's Island*. In Boston he's famous for having worn nothing but zorries on his feet all winter. When you meet him maybe you can discover what Timothy Leary had in mind in *Neuropolitics* when he wrote about "Henson/Drexler Engulf and Devour, Inc."

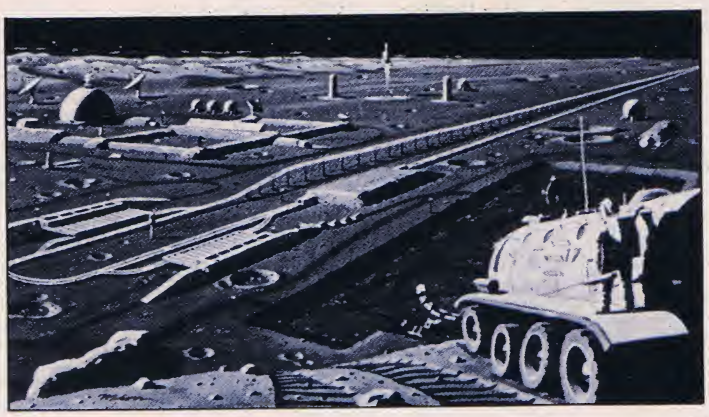
You'll find my husband Keith and me in the fabled Nassau bar. I'm afraid we aren't quite as distinctive as the people I've just described. We're just plain folks; Keith and the kids and I are shown here in a typical Henson family scene. All that jazz coming off the machine at right is just lightning bolts; we use it to kill bugs.

Want to get together? Let's meet Wednesday night, May 16, in the bar of the Nassau Inn.

PHOTO P.K. WEIS



ART: TED ENIK



ART: PIERRE MION, COURTESY NATIONAL GEOGRAPHIC

Within our lifetime, thousands of people will be living in space colonies. But before any spacefarers pack their bags, the colonies have to be built.

BUILDING THE FIRST SPACE COLONIES

By GERARD K. O'NEILL

Dr. Gerard K. O'Neill is universally recognized as the world's leading space habitat authority. The Princeton physicist's studies on human-built settlements in space began in 1969 as the result of undergraduate teaching at Princeton and were first published in 1974. He has since written various works on the subject, including the book: The High Frontier: Human Colonies In Space.

The basic approach to getting into space is not very complicated or profound. It's simply a way to reach a substantial level of space manufacturing and production payback within the limitations of the space-shuttle system, very much with the help of a kind of mass-driver reaction engine and a mass-driver lunar transporter.

The Mass-Driver Machines

We like to think of a mass-driver as a special type of rocket for space, and also as a lunar-materials transport machine.

There are about 20 coils in the mass-driver model; they're about six inches in diameter, wound of square copper wire. These coils are assembled on pieces of plumbing pipe, which the bucket that carries the material rides on. The 20 coils make up an eight-foot acceleration section. It's done in a very simple-minded way: the bucket has just one big driven coil. It rides on its automobile starter brushes, and as it goes past each drive coil, it triggers a microswitch which fires a capacitor through a silicon control rectifier, and that coil gives the bucket another push, so that there is a sequence of 20 such pushes that does the complete acceleration process. Then the bucket gets friction-braked to slow it down, but the contents keep on going.

We had a mass-driver model at Princeton. It was run on only one test, with liquid nitrogen cooling the bucket coil. It was designed to be operated that way, but we did only one test because we didn't have any adequate way of stopping it. We cooled it down so its resistance would be low—the bucket is fed by current from a set of automobile storage batteries—and the device for stopping the bucket when it flies off the end consists of a lead brick. We were able to recover the bucket, even though it did penetrate about a quarter of an inch into the lead brick. The second model is being built with optical triggering, and will, I hope, be considerably less crude.

The performance of the mass-driver in that test was that it accelerated the bucket from zero to 80 miles per hour in a tenth of a second, within a space of eight feet: that's 35 Gs of acceleration. The second model is designed for much more. As far as we can tell, the theoretical limits for these machines are far above a thousand Gs. In a production version of the lunar machine, we expect to be running in the 100- to 200-gravity range. For the mass-drivers to be used as rocket engines, using powdered external tanks from the shuttle as reaction mass, we expect something more like a thousand Gs of acceleration.

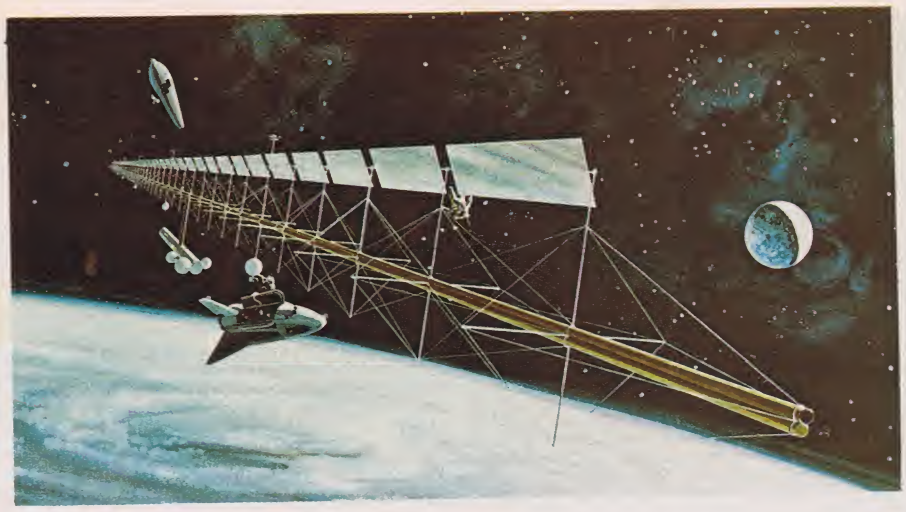
A Sample Mission for a Mass-Driver Reaction Engine

Once the shuttle gets working, people will want to go up into low orbit and begin learning how to do practical tasks. A contractor working for the Johnson Space Center has developed a concept for a low-orbital workshop in space. It would involve taking up beam sections, which would be extended

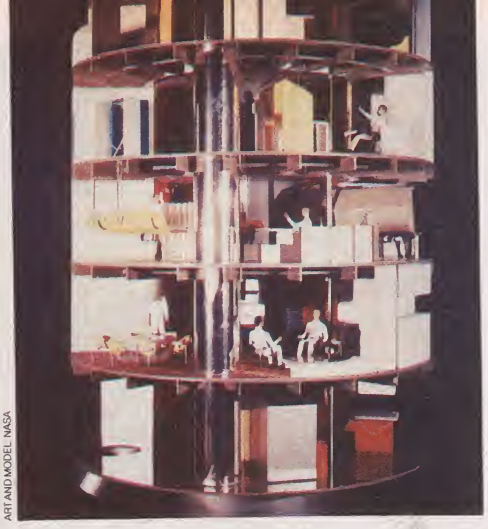
ART: RON GUIDICE, COURTESY NASA

Opposite page: A mass-driver as it might look on the surface of the Moon, set up to launch lunar soil to a space chemical factory.

Above: Two space colonies of the Stanford Torus variety. Mirrors overhead reflect sunlight into the interior of the space habitat.



A key element of O'Neill's bootstrap scenario is the construction of a mass-driver tug in low-Earth orbit. External fuel tanks from the space shuttle could be powdered into a fine dust and used as reaction mass for the tug.



ART AND MODEL: NASA

Another use for external fuel tanks might be to convert them into living quarters, above, for space workers.

from the shuttle. Then a beam-builder would extend them still further. A little zero-gravity equivalent of a crane house moves along, placing things along a type of strong-back device. Something like that is going to be a first step, no matter where we go from that point.

A typical mass-driver reaction engine would be several kilometers long, with a total mass of two or three hundred tons. The total power is about three megawatts. It should run at about 75 percent efficiency, and would be able to put out roughly a fifteenth of a kilogram of material per second. We would get the material by powdering the external tanks from the shuttle, which is the reaction mass that we can get most easily and cheaply in low orbit for these tasks. The idea would be to operate by collecting six months or so of shuttle payloads in low orbit, and then taking those payloads—some 700 tons or so—out to the distance of the Moon, roughly a 150-day trip. The 700 tons of payload would be put in lunar orbit.

The mass-driver would return in a rather short time, because it would now be unloaded, using the remainder of the reaction mass. It would end up back at the shuttle again after about 200 days. During that same 200 days, another 700 tons or so would have accumulated from shuttle flights, assuming something on the order of 50 or 60 shuttle flights per year. After two or three years, it would be possible to deliver up to two thousand tons of material to the right place.

The key items, adding up all the bits and pieces really needed on the lunar surface, would total about a thousand tons, of which the mass-driver is less than a quarter. With that material a mass-driver could be put into operation on the Moon. It would be able, in terms of the capacitors, the aluminum coils, and all the rest of the components it contains, to put out about 600,000 tons per year of the lunar materials. However, the power supplies that would be emplaced on the lunar surface would be adequate for only one-twentieth of that throughput, because the power supplies, being photovoltaic, turn out to be far more massive than the mass-driver itself. That's an illustration of a key element in this sort of bootstrap approach, making a minimum investment at each stage, and getting a maximum return.

We assume that the regular crew on the lunar surface would not have to be more than ten people, requiring only about 40 tons per year of resupply from Earth. That's ten kilograms per person per day, a pretty husky resupply allotment.

For the 1,000 or 1,100 tons needed on the lunar surface, an equivalent mass of ordinary chemical propellants, such as liquid hydrogen and liquid oxygen, is also needed. These propellants must be brought up from low Earth orbit, where the space shuttle brought them, and that's all added into the budget.

There are a lot of other small bits and pieces needed from Earth's surface, pushing the total up to 3,000 tons—something on the order of 100 shuttle flights. At a traffic model of 50 flights per year exclusively devoted to this kind of program, at $20,000,000 per flight, the total expenditure is one billion dollars per year, certainly not an excessive travel budget.

Completion of that project would create the basic ability to bring 30,000 tons of material off the surface of the Moon and receive it at a particular point in space each year. Therefore, an ante of 3,000 tons at shuttle altitude nets roughly ten times that amount per year of lunar material coming out. However, getting to this point will be no small task.

Building the First Colony

Processing all that material is the next phase. We have concluded that a total personnel force of 150 people would be required in space, working in the processing facility. That would be sufficient, according to our 1976 study, to process those 30,000 tons per year of lunar materials, resulting in approximately nine kilotons per year of fabricated silicon and metals.

Chemical process plants, mass-drivers, and all other fancy aerospace hardware are the sorts of things properly manufactured on the surface of Earth, and brought up in pieces in the shuttle. Manufacturing in space, in the early days at least, is limited to very simple and repetitive objects. The thing needed more than anything else turns out to be habitats, "costing" ten tons per person.

There was a study carried out in the summer of 1970 by our Group 2, headed by John Shettler, of what sort of initial habitats would be used. His conclusion was that the most natural thing was to convert the shuttle external tanks into 21 separate apartments for as many different people. One would connect cables to these tanks, and spin them for whatever gravity is required, since the tanks are already designed to take considerably more than one G. It seems to be, at first blush, a reasonable way of arranging the initial habitats. Eventually, of course, most of the people would be living in habitats which had been manufactured in space, presumably very simple and repetitive ones; a kind of Levittown, I think. We could hope to go to something a bit more couth a little bit later.

The next most massive thing required is photovoltaic power supplies, not only to operate the process plant, but also to upgrade the lunar mass-driver, eventually, to its full capability of more than half a million tons of material per year. After consulting with professional extractive metallurgists, and redesigning the chemical processes to be used in space, we were able to reduce the peak temperature occurring anywhere in the process cycle from 2,300 degrees, which is mighty hot, down to about 1,100 degrees, right in the normal range for typical chemical processes used here on Earth. That took us a big step closer to a practical operating system. I think the next obvious step is to set up something with bits of aluminum and glass tubing and retorts and Bunsen burners on a bench top, and have something where you can pour in, perhaps, a child's sand

shovel of artificial lunar soil at one end, and get out silicon and aluminum and liquid oxygen at the other end. That's not by any means out of the question, but it's clearly going to require some money to do that.

The Bootstrap Point

Just to sum up where our balance sheet is at this point, we've had to put in about two year's worth of shuttle flights to get to the point where we could bring out the lunar materials in reasonable quantity. Then another year of shuttle flights, on this model, would bring us to the point where we could process that 30,000 tons per year of materials. So already we're at a bootstrap point; that is to say, we're producing on the order of nine or ten thousand tons per year of finished products in space, plus a lot of oxygen, from a total investment, up to this point, of only three or four thousand tons that we put in over a period of several years. So we already have a big leverage multiplier in our favor.

I'd like to give you a sort of over-all growth pattern for the manufacturing capability in space, during a hypothetical seven-year period. We assume, as I said, about 50 flights per year for the first three years, then 60 per year for four more. After three years, the process throughput capability in space goes up to the initial 30,000 tons. Then, during the next four years, it builds up, at about 150,000 tons per year per year—like the units of an acceleration. The 3,000 people needed in space at the end of those seven years, assuming that we still haven't developed agriculture in space or built any big space habitats, are still living in converted shuttle tanks, and must be resupplied from Earth. At that point, the fabricated output rate in tons per year would be almost a hundred times the resupply rate that would be required for those people. So it seems there is some very useful leverage.

The end result? A pastoral village in space, as imagined by Don Davis. This idyllic scene is set inside a Bernal Sphere. At top right is the habitat's axis, so across the river and uphill is low-gravity housing.

The Big Question of Economics

The next big question is that of economics. We shouldn't throw money down the drain unless we're going to get it back. Investment analyses indicate that if we were to sell stock in this (we're not at that point yet), even at high interest rates it would probably return a substantial profit and give us a large benefit-to-cost ratio.

It is essential, for economic payback, that our program experience an exponential growth. A simple linear growth (putting in X dollars of input, say, launch capacity, in order to get Y dollars of throughput of your space manufacturing, with the same multiplier between the X and the Y) will never pay back your initial investment. You must have exponential growth of the productive capability if you're going to come out with a benefit-to-cost ratio higher than one.

This leads us to the economics of our hypothetical seven-year program. The first year of such a program—presumably after an already substantial amount of lower-level research and development—will require a billion dollars. That's very consistent with the scale of the shuttle, which in its peak year, I think, just passed with something like 1.5 billion. The next year will cost two or three billion—these are Apollo-like numbers in this region—finally building up to our peaks, which get into the range of five to eight billion dollars in our particular model. The numbers go up mostly because we assume that we will be paying 10 percent interest in constant dollars all during the time we're constructing our manufacturing capability.

For the first several years, all production in space goes into increasing productive capacity—the buildup from near-zero to 600,000 tons per year. The question is, how do you value the products which you build? The typical model that everyone tends to use is satellite solar power, whether or not that will turn out to be the prime target for space manufacturing. It's a convenient model, because it's been studied fairly thoroughly. Studies show, for example, that a satellite power station for 10,000 megawatts is going to end up weighing something like 100,000 tons. If we then assign it a value of $500 per kilowatt of installed generator capacity, that figure being taken from the electric-utility industry, we can make some valuation of the products of this space manufactory. And the valuation which has been assumed, in this particular scenario, is on the basis of about $500 per kilowatt on Earth. That transforms back to earnings at the rate of about $18 per kilogram of throughput in the space manufactory.

It should be noted that we've biased things in a fairly cautious manner by assuming, first of all, research and development costs to get to this stage which are taken straight out of the shuttle experience, and that means thirty to sixty million dollars per ton of hardware that has to be developed. We're referring to noticeably different hardware; we're not talking about re-

(continued from page 64)

Some Questions About Space Colonies

answered by Gerard O'Neill

PHOTO: DAVID HUTCHISON

What kind of training will be required? As much as for the astronauts?

It will be much more like the education of Peace Corps people than that of the astronauts, because the numbers are much more similar. There are, after all, only 50 or 75 astronauts, who are necessarily tremendously highly trained; the Peace Corps people number ten or twenty thousand. They are also dedicated, but the degree of training, and the rigidity of programming, is far, far less. The astronauts are each being asked to do the work of 10 or 20 men during the time they're in space; we certainly won't expect that of colonists who are going out simply to do a job.

What chance is there for the average person?

What other kind of people are there? That's the kind that will be going to even the early habitats, I believe. The sort of people who'll go into the first space habitats will probably be the sort you'd see cooking in restaurants and running laundries and doing every sort of human activity that is necessary and productive. When you have 10,000 people, you have a community; you need everybody.

Can one apply to be a member of an early space colony?

That's the most frequent question of all. I think we're deliberately not taking any sign-up lists yet. People may make them up informally, but it's just too soon for that. Students often ask, "What field should I go into?" The only honest answer I can give is, "In the long run, we're going to need all the specialties we have here on Earth, including, very specifically, the artists, writers, musicians, and poets. If there's any one of these things you're good at, then do it, and try to do it very well indeed." The only other thing you'll need is to be able to get along with people, not only to be a good worker, but to be someone who other people enjoy working with. I suspect that what will look good on an employment application for someone who wants to go into space is a record that shows you've held down a job and done well, and that your fellow workers think you're a good person to work with.

Why would people want to live in space?

Human habitats will be built in space for probably all the wrong reasons. If we look at the way our own country was settled, it was for what many of us like to think of as altruistic motives; but we look back and see the worst possible reasons. It was for the basest kind of economic gain. However, there were other settlers who came later on, who were spiritually motivated: their reasons were religious, and they wanted freedom. This country was settled for all sorts of reasons, some right and some wrong. In space, the early colonies will be there for strictly economic reasons, which is not necessarily bad. If you're providing cheap energy for Earth in unlimited quantities, for every nation, you may be doing more in the long run for the betterment of humanity than you could by almost any other method.

Later on, there will come a time when there isn't that compelling drive to make every person-hour count, but instead people will have the leisure to begin to build for the sake of having some room, or some physical and psychological freedom. I think the experiments in new social structures are not going to come in the first generation of space habitats, but that the second generation may follow in 10 or 15 years.

If you gave me a choice between 18 different types of space habitats, I would pick the most democratic one to go to: the one where I would have the least fear that I was going to be controlled by some kind of Big Brother. If you ask me what I suspect is going to be the government of space habitats, I suspect we'll find every form of government we've had on the surface of Earth, including the bad ones.

One of the most appealing things to me about the possibilities of space habitats is that a relatively small number of people, like five or ten thousand, could be really independent in the way of food, energy, and all of the essentials, and therefore be able to govern themselves with leaders that were close enough to pass them on the sidewalks every day, rather like the old city-state concept. There is a lot to be learned from some of the commune experiences of the past few years, and it's my hope that the space habitats, because of these unique possibilities for independence, will be able to continue that social exploration and will perhaps be able to learn things that will benefit many of us back here on Earth.

Can microwaves be used as weapons? Are they dangerous?

They can't be very effective as a weapon. One reason is that the beam intensity is very low; the energy density is less than that of sunshine, and if that sounds strange, the reason is that it's there all the time. Sunshine is there on the average about one-sixth of the time.

Not enough research has been done on the long-term effects of microwaves. Even though the serious dangers are probably not very great, I feel we should do extensive research, very intensively and as soon as possible, to understand and prevent any problems before we begin using microwaves in large quantity.

I spent ages 17 to 19 as a radar technician in the Navy. The problem, I think, is not that microwaves are so inherently dangerous, but that for many years we didn't think they were dangerous at all. That is not true. There is an enormous difference between the ionizing radiations in a nuclear reactor, which take many feet of iron and concrete shielding to stop, and which you can't shut off, and microwave radiation, which you can kill by throwing a switch, and where all it takes to completely block out the beam is a layer of household aluminum foil. It's a very different level of risk. I still feel we ought to explore it in great detail, and, above all, not commit the error of the early nuclear technologists, who tended to speak only to each other, assuring each other that there were no problems, without ever turning the problem over to outside groups.

What are the advantages of space colonies?

Many astronauts, looking back on Earth, have picked out with telescopes tiny places where warring nations were arguing over bits of territory since time immemorial. If we had a human habitat in space with people from many different nations, including those warring nations, and they were to look back with the same telescopes, how compelling it would be to think, "What were we fighting about when there is the possibility of almost limitless expansion? Why do we continue to fight over the same tiny boundaries?"

This brings up the fact that the territorial imperative is very deep-seated in all of us. One of the most important effects of human habitation in space will be to make all of us reexamine the whole idea: what is the meaning of territory? Especially when you're in a situation where territory can be extended almost without limit? There's enough unused material floating around in relatively nearby space to build attractive land area that's 3,000 times the land area of Earth. What happens to the notion of territory when territory is moveable, when two groups who can't get along with each other can actually move their territories apart at very slight cost?

What is it that drives one for this sort of thing? I'm sure, deep down, it's the same thing that would have made me try to jump into Columbus' ship, if I'd been a Spaniard back in the 1400s and there was a new world to be discovered. There is this drive which is in a great many human beings, to try to explore, to go out into new dimensions, both of space and of consciousness.

Looking back from a hundred years in the future, what people will then perceive as the important thing about breakout into space will be not so much the immediate energy benefits, but the much deeper effects on our consciousness and our sense of what we are as a race, what we are as a people, what it is that we're here for, if for any purpose. Those are the things which I think will take a hundred to three hundred years even to think about properly. Still, if we remain forever confined on a very limited planetary surface, if we cut ourselves off from the possibility of going out into space, I'm afraid we are likely to limit ourselves very much psychologically as well as physically.

Todd Rundgren

The Sounds of the Future

PHOTO: © 1979 BEARSVILLE RECORDS

In years to come, says musician Rundgren, music will dazzle your eyes as well as your ears.

Todd Rundgren is one of the most multi-faceted figures in contemporary music. Coming into national prominence via 1972's Something/Anything *LP, a two record set featuring Rundgren on all instruments and vocals, Rundgren went on to become a gold record winning producer, handling the chores behind the boards for Meatloaf, Grand Funk and Utopia. Fascinated with producing, he built his own recording studio from scratch. Of late, he has curtailed his recording activities to experiment in video, constructing his own television facilities. In this recent discussion with* FUTURE LIFE, *he explains how he envisions the world of future-rock.*

I'm really not a big fan of rock and roll. I don't think that rock will exist in the future. In fact, I think it went away a long time ago. I believe, however, that contemporary music will always be around, like it's always been around, in one form or another, whether it's ragtime, jazz, computerized or synthesized.

It's hard to predict just how contemporary music will evolve in the near future. In terms of synthesized sound, people will be using a lot more microprocessors soon. A lot of these devices are just meeting with commercial release now and will make a big impact on music during the next few years. For instance, there is now something available called a micro-composer which can store eight separate lines of music. It will remember these eight lines and you can control eight synthesizer modules at once. By interfacing this with a tape machine, you can get a very elaborate control system.

In the far future, scientific advancements will probably lead to there being less actual hardware on stage during live music concerts in terms of instruments and amplification. Roger Powell, of Utopia, for instance, (who worked with Dr. Robert Moog, inventor of the first synthesizer) uses a synthesizer controller that is built into a keyboard which hangs around his neck onstage. It has a scanning system that scans the keyboards and all of his sensing switches. It scans everything and transmits the information back to a remote synthesizer. You don't actually have to have the synthesizer right on stage. He just uses the portable keyboard with no sound-producing elements in it. Very compact.

Personally, I think that *videodiscs* may revolutionize music. (Ed. Note: videodiscs are a new type of software, currently being test marketed, which resemble long playing records but, when played on a special turntable system, reproduce both sound and video imagery on a TV screen.) I see possibilities for rock and contemporary music to do well on videodiscs. It depends on the music involved, however. Dumb music is dumb music, even if you conjure up a dumb visual to go with it.

I think that the success of this new videomusic will depend on the depth of the musical content of the individual act working on disc. A lot of people don't have the imagination needed to make a good visual compatible with music. The first thing I foresee happening is companies reproducing a live concert on videodisc; just a picture of a band playing. Or *A Hard Day's Night* type musical comedies... Monkees-ish nonsense. That's the type of ideas that most people are going to come up with, which I don't think is going to advance the idea as an art form too much.

Eventually, people will see videomusic as a unique and separate art form. I don't think that two independent elements, sight and sound, can be simply grafted together. That's like pasting a picture over a record. Videomusic has to be conceptualized. Music has to be written that will complement the visual and vice versa.

Years ago, music was much more visually oriented, immediate. It was much more graphically written. Then, rock came along and offered a song style that represented a sociological stance, but visualization was not necessarily a part of it.

I think videomusic's time is coming. I'm working on a videodisc at present for RCA. It's a piece of music from Tomita's *The Planets* LP which we'll adapt visually. I'm more interested in the development of videomusic than I am in music in general. Music today is not a stimulating experience emotionally, sociologically or politically. It has become much too establishment-oriented.

But video today is mushrooming. People are affected more by video than any other medium at this point because people watch TV like crazy. It is probably the most influential outside element in their lives. It is more than just an entertainment medium, but most critics have already written it off. I have a belief that videomusic can elevate the video realm. It can also elevate its audience aesthetically. If networks catch on to what's happening with videodiscs, and schedule similar programming, think of the stimulation/elevation factor. You'd have the greatest degree of exposure and the greatest amount of influence possible.

In reality, of course, videodiscs won't be a recognizable market phenomenon for another five years. The creation of a disc takes at least as much money and time as the recording of an LP. At this point, however, that sort of money can't be spent because the return at the consumer level is nonexistent.

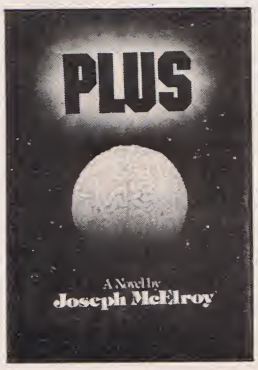
Ultimately, though, videomusic will be an accepted part of the entertainment and art fields. I think the video process will actually improve the overall quality of contemporary music, too... which will be a relief to me. I'm just an old fogey, I guess, 'cause I don't understand the stuff that kids are listening to these days.

Mainstream Invades SF

Literary critics have never thought too highly of science fiction. Most of them refuse to believe that the genre has changed much since the pulp era of lurid covers and impossibly hackneyed plots. Their attitude seems to be that if a book is good, it must not be science fiction.

It's time for them to take a second look. Over the past few years, a number of mainstream authors have been drawn to SF. The boundless realm of speculative fiction has proven fertile ground for their world-making ideas and SF's open-minded audience has provided them with a legion of instant readers. In short, they don't need critics to approve of their work.

Joseph McElroy is a case in point. A bona fide critics' darling, he has managed to non-plus his admirers with **Plus** ($4.95 in paperback from Knopf), a tale of unexpected scientific discovery.



Imp Plus is a disembodied human brain installed in a satellite and placed in orbit to watch chlorella grow. The brain dutifully reports the facts to scientists back on Earth with no sense of self-import until, one day, it stops in mid-transmission, realizing that Imp Plus is indeed *something* but not knowing exactly *what*.

SF writers have transplanted human brains into machines before, but *Plus* depicts a first crude effort during a time when the process has yet to be refined. As a result, Imp Plus stumbles over the memories, words and sensations of the man it once was before discovering that the satellite capsule is filled with a new organism, one that the brain cannot completely control.

Radiation, the Sun, weightlessness—one or all of these elements has given Imp Plus the power to affect change on a molecular level—to fine-tune its own DNA and that of the chlorella sharing its capsule. Imp Plus becomes the first real space dweller, needing only sunlight to survive and prosper in space.

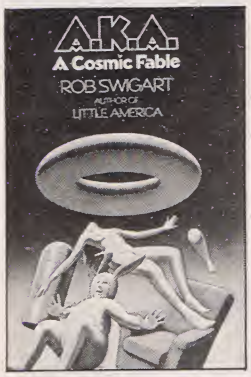
As earthbound scientists nervously try to regain control of their spacecraft, Imp Plus concocts its own plan of action—a plan that brings this strong and original story of personal evolution to a smashing close.

While authors such as *Plus'* McElroy take old concepts and make them new, some authors prefer to believe that if an idea has worked twice in SF, it will surely work a few times more. Anthony Burgess is just such an author. Nearly two decades ago, he offered a shockingly bleak and violent future in *A Clockwork Orange* and *The Wanting Seed*.

This year, he has returned to the genre with much fanfare, bringing forth his own sequel to George Orwell's classic *1984*, aptly titled **1985** ($8.95 in hardcover from Little, Brown and Company). *Clockwork Orange* fans take note: Burgess' expectations are still pretty bleak.

1985 shares a number of cacotopian characteristics with his earlier ventures. Now, cacotopian is an adjective of Mr. Burgess' own device. It comes from the Greek *kakos*, meaning bad, and *topos*, meaning place. Now, if you're willing to accept even part of the author's instant anti-utopian vision, you might as well cross tomorrow off your calendar. In *1985*, Big Brother has been overshadowed by the unions, oil-rich Arabs who have bought everything except Buckingham Palace and gangs of roaming young intellectuals who'll kill you if you can't quote Homer in the original Greek. If the above delights aren't depressing enough, there is always inflation to round out this futurescape.

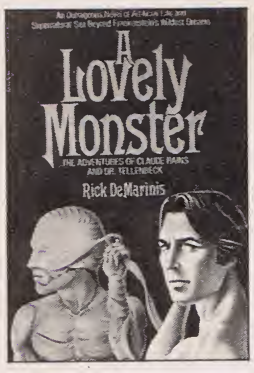
Overall, the book is short on vision and long on venom. Despite the author's evident relish for a good horror story, the most interesting part of the book for many readers will be the lengthy interviews which precede and follow the novel itself. Here, he gives his scholarship a workout, explicating the original Orwell with lively intelligence and certainty. But his update suffers from an adamant refusal to see even a single optimistic possibility in the near future.



In **A.K.A. A Cosmic Fable** ($4.95 in paperback from Houghton, Mifflin), Rob Swigart sets much the same stage as Mr. Burgess (a foully polluted planet covered with crime-ridden slums), but comes up with a very different and even more bizarre conclusion. Burgess, of course, isn't helped out by the presence of fictitious Avery Krupp Augenblaue, his orgone-powered spaceship or a very sexual revolution in his scenario.

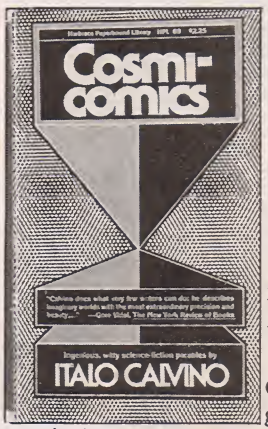
Fable's Augenblaue, president of Augenblaue AeroSpace and humanity's first envoy to the stars, is due back from his ten-year sojourn aboard the *A.K.A. Monastic*. His plan: to tell everyone the truth about orgones, those little blue balls of sexual power postulated by Wilhelm Reich in the 40s and declared nonexistent by the U.S. Government in the 50s.

Now, after all this time, Avery isn't supposed to know about his wife and the butler, about his daughter Angela becoming his son Angel or anything about Akley furniture coming with built-in aphrodisiac-producing termites. In fact, since he was last seen with an axe firmly placed between his eyes, Avery shouldn't know anything at all.



But Avery K. Augenblaue is nothing if not resourceful, and he and his pal, the Degenerate White Dwarf, wreak hilarious havoc in this tale of a not-too-probable future. *A.K.A. A Cosmic Fable* is fun, pure and simple, and Swigart does the deed in a marvelously manic style.

A Lovely Monster ($1.75 in paperback from Dell) by Rick De Marinis outrageously updates the Frankenstein story in a style that should please members of the "Me" genera-



tion. Telling the story from the monster's point of view, De Marinis answers the question we all ask when we see someone like Arnold Schwarzenegger or the Hulk, "Who builds the body builders?"

This bizarre California kid is glued together in a swinging singles condominium by the intrepid Dr. Tallenbeck, who uses pieces of a dozen or so people, an ape and a Shetland pony. (Your guess which pieces went where.) None of the graceless scars or protruding electrodes of the original monster mar this lovely torso. Though Claude Rains (named after his favorite matinee idol, star of *The Invisible Man*) *is* a lovely monster, he still fears falling apart the way the original feared fire, and the raucous story of his disintegration is frank, funny and frightening.

Author Italo Calvino turns in a dazzling performance in **Cosmicomics** ($2.25 in paperback from Harbrace Paperbound Library). *Cosmicomics* charts the evolution of the universe in a series of nostalgic remembrances related by an impossibly old family member. Imagine hearing your grandmother recall just how crowded it was before the Big Bang, or that the first person to completely leave the sea behind for land was a jilted boyfriend of hers, and you have a slight notion of Calvino's antics.

For a long time, SF has been considered a literary ghetto, but the legislated limits of Literature with a capital "L" are collapsing. These are but a few of the vanguard who have come to play in the SF neighborhood, because they understand that we've been off the planet, begun hooking everyone into a global communication network, started seeking our galactic neighbors —that we're *living* science fiction, not *Madame Bovary*.

Books in Brief

Science Fiction: An Illustrated History by Sam J. Lundwall ($7.95 in paperback from Grosset and Dunlap), **The Encyclopedia of Science Fiction** edited by Robert Holdstock (to be published this fall, $8.95 in paperback, $14.95 in hardcover from Doubleday). From the looks of things, British publishers crank out some sort of SF encyclopedia or illustrated history about one a month. U.S. publishers, in turn, import these nifty items at the same rate. Thus far, despite the ballyhoo, not one publisher on either side of the Atlantic has come up with an adequate sourcebook on the genre. Two of the newest entries into the encyclopedic sweepstakes show why.

Lundwall's *Illustrated History* comes very close to being coma-inducing. An exceedingly subjective, cursory overview of the genre, it attempts to touch all bases; dragging even Dracula and Boris Karloff into its helter-skelter design. Even the illustrations, usually the only valid excuse for spewing out these oversized books, are lackluster.

The *Encyclopedia of SF* fares somewhat better, although it is not really an A to Z accounting of anything. The book is, in reality, merely a collection of essays on different facets of the genre (film, art, etc.) penned by British authorities all but unknown stateside. Nevertheless, the artwork is exceptional, with many full-page illustrations in color. Some sort of added credibility is supplied by a perfunctory foreward by Isaac Asimov, author of 200 books and at least twice as many introductions to books such as this. *Joseph Kay*

World Without End by Joe Haldeman ($1.95 in paperback from Bantam). Captain Kirk and his usual entourage visit an inside-out world populated by a three-caste society of winged furry creatures: the city folk, the country fold and the Magicians who live in the low-gravity areas of this alien O'Neillesque invention. As usual, these folks don't know what "outside" means and they can't understand the plight of the *Enterprise*, tapped and being drained of power by the highly sophisticated ship-world. All they know is that Kirk and friends resemble some unpleasant visitors from a while back—the Klingons. Looking for a way out, the *Star Trek* regulars take a Magician hostage and head for the power center. One thing is for sure: you couldn't do this story convincingly on the screen. It's a fun book. *Robin Snelson*

Nightworld by David Bischoff ($1.75 in paperback from Del Rey Books). David Bischoff's first novel is an amiable mixture of gothic goosebumps and futuristic fancy. Set in the far-flung future, *Nightworld* takes a basic monster movie ploy and adds a healthy dose of nuts and bolts for good measure. In the veddy English realm of Ferwold, a mad computer named Satan creates a horde of hellish hardware designs. Mechanical monsters such as vampires, werewolves and dragons roam the land by night, striking terror into the hearts of local denizens. It's up to a spaceage demon hunter and his young assistant to save the day by pulling the plug on IBM's answer to Dante's Inferno. Suffice to say a goodly amount of ghoul watching takes place before the finale. (By the way, *Nightworld* offers one of the most delightfully wretched female lead characters in the history of adventure sagas. . . the kind of girl you'd like to bring home to mother. . . and then leave there.) *Ed Naha*

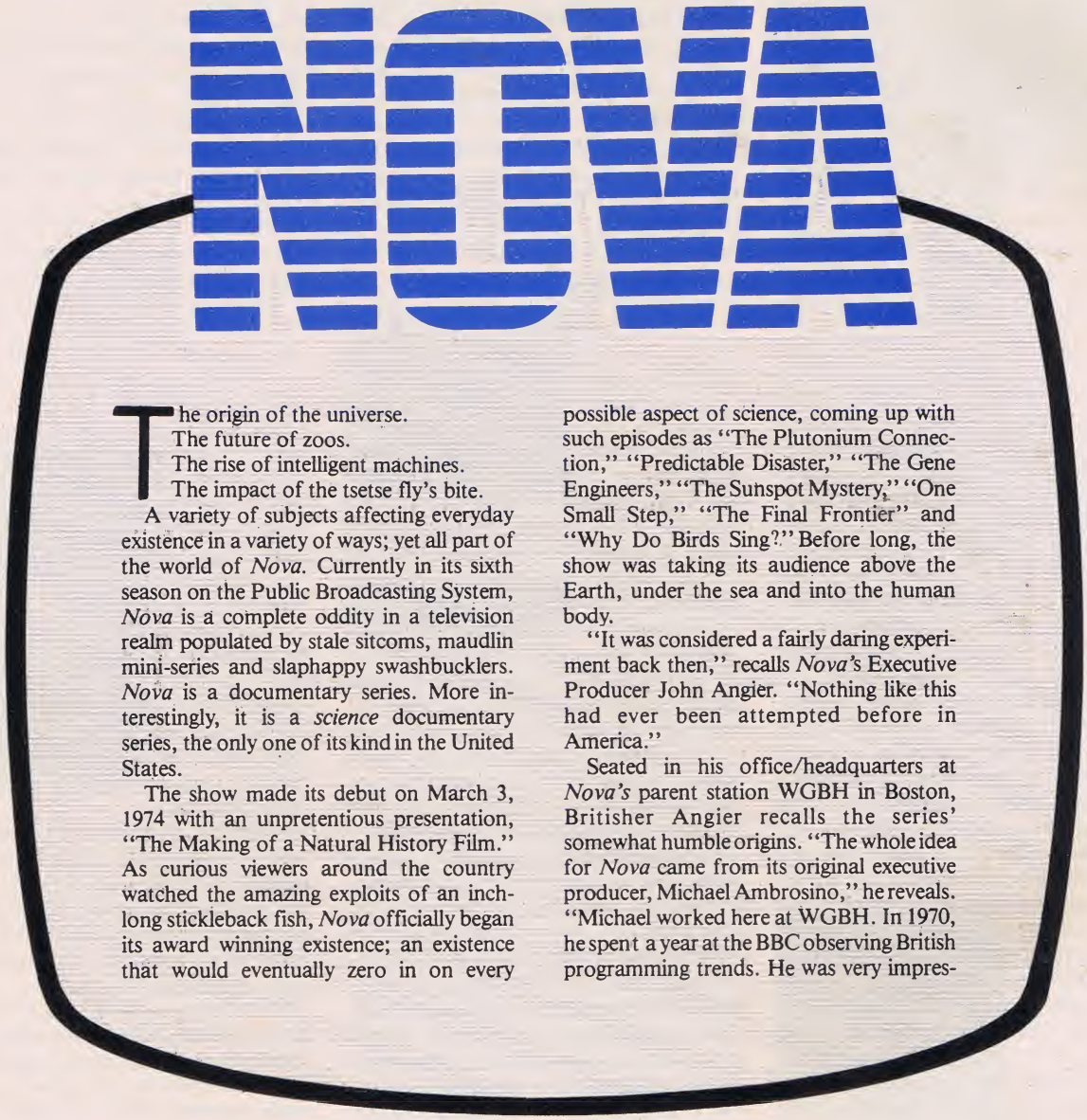
Titan by John Varley ($9.95 in hardcover from Berkley/Putnam). With the incredible scene he's created for *Titan*'s main action, John Varley sets a new standard for science fiction worldmaking. Themis is a 1,300-kilometer-wide donut populated with sentient blimps, three-sexed centaurs and belligerent angels that has taken up orbit around Saturn.

While you might expect the characters or action to take a back seat to Varley's richly imagined landscape, this is clearly the story of Captain Jones' personal odyssey. She is determined to solve the mystery of the alien-made world—even after it tears her ship apart and literally digests it .

From the moment Captain Jones emerges naked and hairless from the soil of Themis in a pastoral rebirth, she heads for the center of the massive structure, certain that someone must be in control. It soon becomes apparent that if anyone *is* in control, they've let the neighborhood go to pieces. But the magnificent old wreck's flora and fauna challenge Captain Jones and her traveling companion every step of their long climb in search of an answer just as inventive as Themis herself.

Varley's adult "off to see the wizard" adventure leaves just enough loose ends to whet the appetite for the sequel promised early next year. *Bob Mecoy*

America's friendly video egghead regularly turns a group of dedicated TV producers into a squad of scientific Sherlocks.



SCIENTIFIC SLEUTHING

By ED NAHA

The origin of the universe.
The future of zoos.
The rise of intelligent machines.
The impact of the tsetse fly's bite.

A variety of subjects affecting everyday existence in a variety of ways; yet all part of the world of *Nova*. Currently in its sixth season on the Public Broadcasting System, *Nova* is a complete oddity in a television realm populated by stale sitcoms, maudlin mini-series and slaphappy swashbucklers. *Nova* is a documentary series. More interestingly, it is a *science* documentary series, the only one of its kind in the United States.

The show made its debut on March 3, 1974 with an unpretentious presentation, "The Making of a Natural History Film." As curious viewers around the country watched the amazing exploits of an inch-long stickleback fish, *Nova* officially began its award winning existence; an existence that would eventually zero in on every possible aspect of science, coming up with such episodes as "The Plutonium Connection," "Predictable Disaster," "The Gene Engineers," "The Sunspot Mystery," "One Small Step," "The Final Frontier" and "Why Do Birds Sing?" Before long, the show was taking its audience above the Earth, under the sea and into the human body.

"It was considered a fairly daring experiment back then," recalls *Nova's* Executive Producer John Angier. "Nothing like this had ever been attempted before in America."

Seated in his office/headquarters at *Nova's* parent station WGBH in Boston, Britisher Angier recalls the series' somewhat humble origins. "The whole idea for *Nova* came from its original executive producer, Michael Ambrosino," he reveals. "Michael worked here at WGBH. In 1970, he spent a year at the BBC observing British programming trends. He was very impres-

ART: BARCLAY SHAW

sed with the British tradition of science journalism on TV; most notably represented by a series called *Horizon*.

"*Horizon* took science and presented it to audiences on a comprehensible level. Ambrosino felt that there was a need for a similar type show in America; a need for the American public to better understand the world around them through the process of scientific investigation. When he came back to the states, he brought up the idea at WGBH. He envisioned a show patterned after *Horizon*. They liked the idea and work on *Nova* began.

"The show was done in cooperation with the BBC and, to this day, we both produce our own documentaries in the states and co-produce episodes with *Horizon,*" says Angier.

Angier, himself a former BBC producer of *Horizon,* worked on *Nova* several years before succeeding Ambrosino in 1976 as Executive Producer. He readily admits that keeping *Nova* fresh, week after week, is a challenge. "Aside from funding," he confides, "our biggest problem seems to be one of time. Basically, we're taking an unlimited source of material and trying to present it in 26 interesting shows per season, each show being only an hour in length. What you're constantly trying to do is squeeze as much value as you can out of the time allotted.

"It means working on ridiculously tight deadlines. Production of a film, unless you're in complete control, can just go on and on. There's always a good reason to extend your research for just a couple of more weeks or do just a little more filming. After all, when you're producing a show on Einstein, or nuclear energy or computers, you feel you have that privilege. In reality, you never do."

Luckily, for all concerned, *Nova* has managed to hone in on fascinating topics week after week for six years, producing over 150 concise, hour-long science adventures. This production miracle is largely due to the interplay between Angier and his staff of in-house producers. "We have a very creative staff," he beams. "The producers we have right now have come to us in two ways; either they've been taken in as experienced documentary producers or they've started on the series in lesser positions and worked their way up. Each season, we kick around ideas. Once the concepts for 20 original shows are derived, the detective work begins. And each individual episode requires a lot of detective work."

Nova Executive Producer John Angier

The Eyesight Caper

Veronica Young does not look like a detective. Yet, in the field of scientific journalism, the lithe Australian filmmaker outdoes the efforts of most Dashiell Hammett characters on a daily basis. As one of *Nova*'s staff producers, she must tackle fairly amorphous topics and zero in on one dramatic aspect for a 60-minute presentation. Currently up to her neck in film, literally, for a fall 1979 show on "Vision," she takes time from her editing room chores to reveal what it's like to be the PBS equivalent of Sherlock Holmes.

"Producing a *Nova is* sheer detective work," she smiles, echoing Angier's words. "It's very much like a jigsaw puzzle being put together. You start off with an idea about what the framework is and then you begin to fill in the pieces. You're surprised, more often than not, by the pieces that do show up."

Referring to the mounds of film spools in one of WGBH's editing rooms ("the only one with a window"), she states, "Right now I've just started editing 'Vision.' I even have a little more shooting to do. But editing, this is the reality of a show. Here's what I have to make a film out of. There's no room for fantasy now. This is where you push and pull the jigsaw puzzle apart and together again. Even here you continue your detective work in a way, but there are limitations. Before, in the planning stages, your horizons were wide open. Here, you have to construct a whole from only the pieces physically at hand."

Young's episode on sight had its origins some six months ago. "First, we had to arrive at the idea," she says. "The subject matter for *Nova*s are a combination of what the producers are interested in and what John believes will constitute a well-balanced series. Sometimes the idea comes from him and he'll say 'why don't you check this out?' Sometimes it will come from the individual producer. I'll go in and say 'I'm interested in the following; what do you think?' He'll say yes to this, no to that and go ahead with this.

"In this particular instance, our interests happened to overlap. I wanted to do a show on vision, but I didn't know if it would be a show on the eye, on vision per se, on going blind, on being blind, on the rehabilitation of the blind. I didn't know whether it would deal with perception, whether we would be philosophical or whether we would be more concerned with the brain than the eye. These were just some of the fundamental questions we faced at the very beginning. All I had to guide me was the fact that all of us are interested in our eyes. And I'm interested in making films that reach a broad range of people."

Before long, Young found herself preoccupied with the concept of blindness. "I started to wonder what it was like to go blind," she explains. "What are the chances of all of us losing some of our sight during our lifetimes? What exactly *is* blindness? What is going on to prevent it or to help people who are going blind cope?

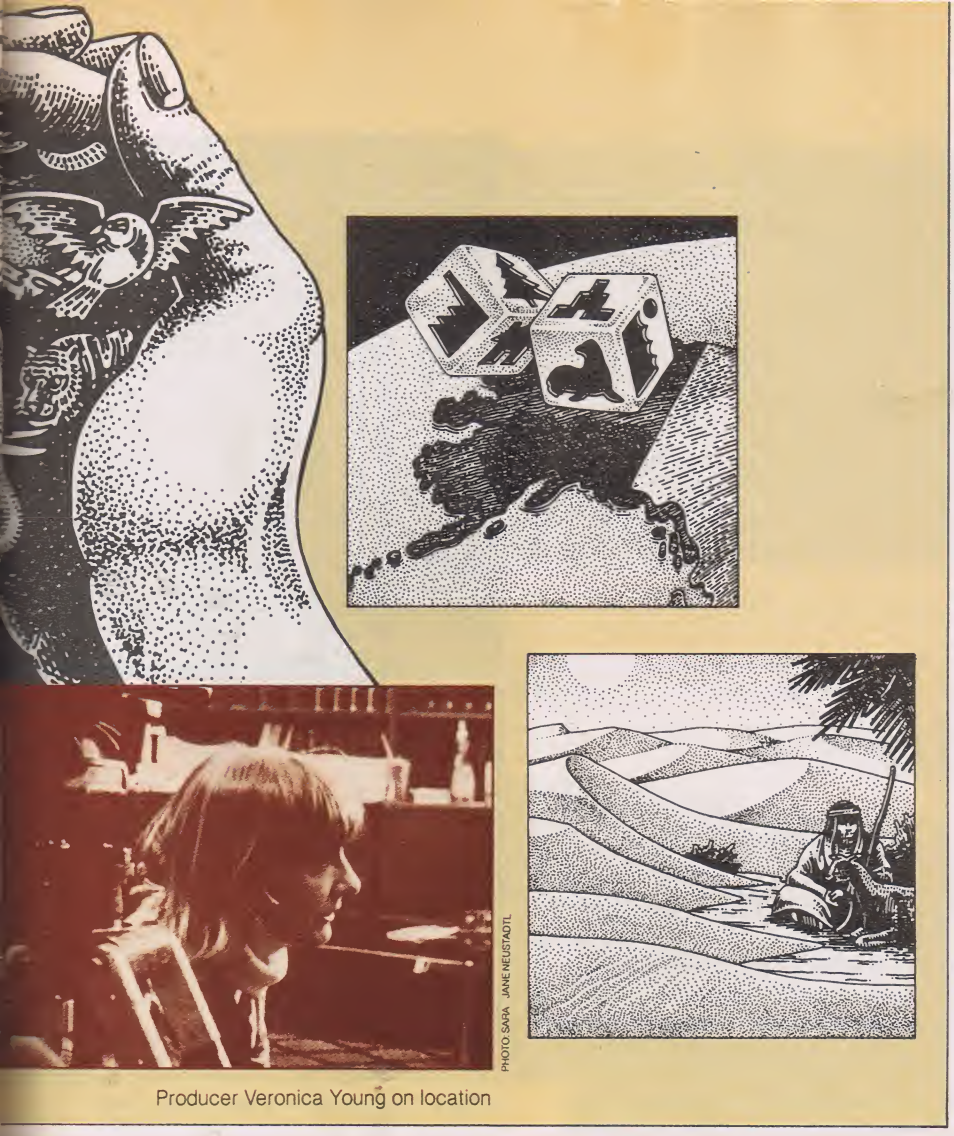


PHOTO SAPA JANE NEUSTADTL

Producer Veronica Young on location

"The first question for me, then, was how many people are there who lose their sight? I found a real story there. Visual problems are on the increase worldwide. That was the first strand of the finished show."

Her first clue in hand, the producer then had to seek out additional puzzle pieces. "Was there really a problem here to be talked about? Should I deal with world blindness? Should I deal with the rise in glaucoma cases, the massive amount of cataracts found in India and the third world or should I narrow my focus? I decided to concentrate on the U.S. We have considerable problems, it seems, on our own doorstep."

With a stage now set for her *Nova*, Young began doing research. Joined by a production assistant and a researcher, she began in her "own backyard." "Being in Boston," she says, "we're in the heartland of clinical and medical academia. I began to talk to local opthalmologists. We got off to a good start there. The next development that occurred, rather coincidentally, was a meeting in Kansas City of the American Committee of Opthalmology taking place just at the time I was researching heavily. I spent several days up there talking to the creme de la creme of the professionals, interviewing clinicians and researchers.

"Because we zeroed in on blindness, we felt that our show had to be about people, about patients who were suffering from visual problems. I wanted this *Nova* to be focused on the people, their doctors, their treatment and their problems. We wanted to do case studies and, through the doctors, came the patients."

Even with the pieces of her *Nova* falling into place rapidly, Young was still in the process of encountering new hurdles to clear. "Then came the big question," she recalls, "which visual problems are we going to talk about? There is a long list of things that can go wrong with the eye. Half of the people in this country wear glasses. But what causes people to go blind? Two diseases that were way atop the list were diabetic retinopathy and glaucoma.

"Glaucoma is something that a lot of people have heard about... the sneak thief of vision. It's a disease that sneaks up on you and can't be reversed. It can't be prevented. The next question is: can it be treated? The answer, in most cases, is yes.

"Diabetic retinopathy is the biggest cause of new blindness of people between the ages of 20 and 60. It's a very serious complication of advanced and long term diabetes. Not everyone who has diabetes is going to get it, but a large proportion do. There are a lot of long-term diabetics whose retinas become affected by the disease. It's a vascular disease, it's a blood vessel disease. Retinopathy is basically the disintegration of the retina. It can't be prevented because it's part of the long-term disease itself. We don't know how to cure diabetes. And because more and more diabetics are living longer and reproducing, the incidence of this disease is really going up."

After finding two diseases, Young went on to explore the fragile relationship between sight and the brain. "We found a condition called Ambryopia, wherein a person can lose the sight in one eye without there being any disease in that eye. As infants, we go through a period of neurological growth when our brain/eye system is very plastic and susceptible to change. Our capacity to see with our eyes is evolving...if it has the correct visual input. Now, let's say a baby is short sighted in one eye and sees quite normally with the other. She will tend to favor the good eye and the poor eye will not be stimulated. Sight can actually be lost. It's basically a connection between the brain and the eye that's at stake, here."

To illustrate the three types of problems, Young contacted a number of doctors, explaining what types of case histories she was interested in. A five-year-old child with Ambryopia was found, currently undergoing treatment. A grandmother in North Carolina who had perfect vision up until four years ago was chosen to illustrate retinopathy. For diabetes, two examples were found: a woman in her 60s currently being aided by sight-preserving medication and a young New York sculptor who is immune to such drugs. "He faces the prospect of having an operation that his doctors feel will keep him from going blind," Young says. "He is unable to make the decision about whether to have his operation or not. So that now takes us into the areas of how people take responsibility, their health, their feelings. He is faced with quite a dilemma here."

The producer feels that the ultimate result of her detective work will be a show that will present a problem, present solutions both practical and proposed for the future and relate them to everyday life. "The case studies in my film aren't just patients," she stresses, "they're people. The doctors are human beings making decisions based as much on their personalities and feelings as the research at hand. To involve an audience in an obtuse subject, you have to hit them where they live. You have to give them something to identify with, then you draw them into it."

Presenting topics in humanistic terms, however, does lead to problems. "During filming," she laughs, "there are times when you'd dearly love to scream. Someone who's brilliant on paper can fall apart on

(continued on page 63)

How to Design a Getaway Special to Space

By G. HARRY STINE

ART: NASA

Interested in coming up with an experiment idea to enter in FUTURE LIFE's "Getaway Special" contest? After all, it is a chance to get your own payload into space. But there will be only one winner, and the judges are going to be looking for an experiment that must, first of all, have a reasonable chance of meeting all of the NASA requirements and specifications and of passing the required NASA safety inspection. So, as a word of advice, before submitting your proposal to us, do a scientific job of gathering all pertinent information first.

NASA set up its "Small Self Contained Payload" (SSCP) program because the space shuttle orbiter is nowhere near as "weight sensitive" as previous space vehicles. When you've got a cargo bay 15 feet in diameter by 60 feet long and a payload capability of as much as 32 tons, there are going to be unfilled nooks and crannies in that payload bay. But, because NASA cannot permit any object aboard the orbiter that might interfere with a larger, dedicated payload or with the safety of the orbiter itself, they've had to put some restraints on the Getaway Specials. Before we go talking about potential experiments, we should make a quick review of the most important restraints and some of the flight conditions that affect experiment design.

First off, the experiment must fit inside one of the standard NASA Getaway Special containers (its weight and volume are not included in your experiment's weight and volume limits). One container for 1.5 or 2.5 cubic-foot payloads has an internal diameter of 19.75 inches and a length that varies to contain the payload. The 5 cubic-foot container is also 19.75 inches interior diameter, with an internal length of 28.2 inches. The container is insulated to help you control the temperature of your payload. The container can be vented to space conditions or remain sealed with its own internal atmosphere. The container top may also have a window if your experiment requires it—and if you want to pay for it.

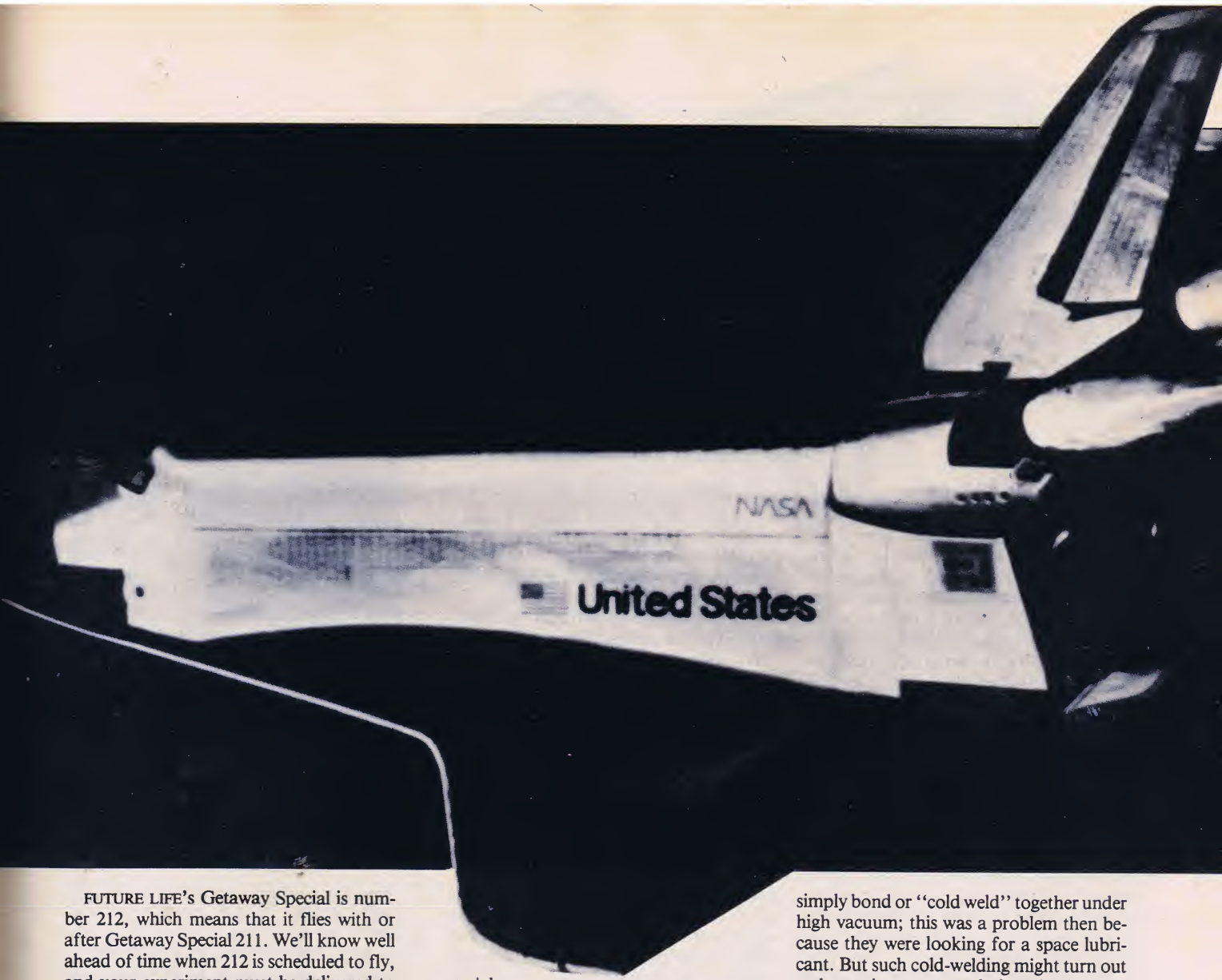
Your experiment must be as the program name implies: self-contained. If your experiment requires electrical power, this must come from the batteries that you provide within the weight and volume limits of your experiment. Shuttle crewmembers in the cockpit of the orbiter will provide you with three switch operations—on and off—plus a verification that the switch commands were received by your payload. Beyond that, it's out of your pocket.

Your Getaway Special experiment must pass a NASA safety check sometime within a year before it is scheduled to fly.

STARLOG/FUTURE LIFE extends Getaway Special deadline

FLASH! The contest deadline for STARLOG/FUTURE LIFE'S Getaway Special Contest has been extended one year—to July 20, 1980. Due to the somewhat complex nature of the Getaway Special—after all, this is a first for NASA—many contestants have proposed ideas that simply will not conform to NASA guidelines and restrictions. (For instance, no matter how hard you try, you just can't fit a human being into the Getaway Special container...) So, we're trying to remedy the situation. We've enlisted the expertise of the Forum for the Advancement of Students in Science and Technology. FASST has developed an informative, understandable "Getaway Special Starter Kit" which will be invaluable to anyone interested in entering our Getaway Special Contest. It includes; 1) a poster outlining the contest and illustrating how it works; 2) a bibliography of helpful articles and publications on what experiments have been done in the space environment and how; 3) a resource list of organizations in different fields of speciality that can offer assistance in your research; 4) the most thorough explanation to date of exactly what NASA will—and won't—allow flown on the space shuttle; and 5) an overview of the shuttle and its capabilities.

The Getaway Special Starter Kit will help you plan an experiment proposal within the guidelines imposed by NASA—and it will also help you learn about the space shuttle and the problems and promise of space experimentation. Now you have more than a year to come up with a winning Getaway Special proposal. For your copy of the Getaway Special Starter Kit, send $3 to: STARLOG/FUTURE LIFE, Getaway Special Starter Kit, 475 Park Ave. South, New York, N.Y. 10016.



FUTURE LIFE's Getaway Special is number 212, which means that it flies with or after Getaway Special 211. We'll know well ahead of time when 212 is scheduled to fly, and your experiment must be delivered to NASA at Cape Canaveral at least two months prior to flight, ready to be inserted into the NASA standard cannister.

Keeping these things and a few others in mind, let's think about a few possible experiments that could be done. Mind you, the judges are not going to be looking for proposals with these experiments suggested. I'm tossing them out here as potential experiments and as something to trigger your own thinking in the process.

If you want to vent the NASA cannister to space conditions in orbit, you can expose your payload to the high vacuum of space, the solar radiation, or the solar wind. But you must make certain that your experimental materials don't release gases into the orbiter payload bay that would affect other payloads or the orbiter itself. With the container open to space, you would be able to conduct some experiments concerning the effect of space conditions on various materials. NASA is going to launch a very large satellite called the Long Duration Exposure Facility (LDEF), but this doesn't mean that you could not fly a Getaway Special experiment to study the short-term effects of the space environment on specific materials.

With your experiment exposed to the vacuum of space, you could run a short vapor deposition experiment.. A small amount of electric power from a nickel-cadmium battery pack could be used to heat to incandescence a wire made of, say, aluminum, thus "boiling off" atoms of the material. When these atoms strike a colder surface that has been properly prepared, they "condense" and form a coating. There are some sorts of vacuum deposition that cannot be done here on Earth in vacuum tanks or must be done in very expensive facilities. This is because the hot atom strikes the cold target material and melts the target. Vapor deposition in space could solve this problem if the base material were kept cold. . . which would be possible by keeping the target surface out of direct sunlight.

A very simple experiment would be one involving "cold welding"—i.e.: how good a bond could be achieved between types of materials by simply joining them in a vacuum. This problem was first encountered more than 20 years ago by the Air Force in the first very-high-vacuum tanks. They found that two similar metals would simply bond or "cold weld" together under high vacuum; this was a problem then because they were looking for a space lubricant. But such cold-welding might turn out to be an important technique in the construction of space facilities. Which metals do this trick best? How strong is the cold-welded bond? Will dissimilar metals cold-weld? This is an experiment requiring practically zero internal power. It could be activated mechanically in space by one of the on-off signals. When you get the package back from NASA at the end of the flight, you make strength tests on the bonds. This is important data for future projects in space industrialization. Not only will it tell us more about cold welding, but will also tell us how to build and operate sliding joints and other mechanical fixtures where metallic surfaces must *not* weld together and must slide over one another!

If you specify a window in the top of your Getaway Special cannister, you can put a sequential movie camera aboard, preferably spring-wound and activated to eliminate the need for on-board batteries and the subsequent heat rejection problems. You could load the camera with any number of available films that are sensitive in specific regions of the infra-red spectrum, for example. Or you could load a general purpose film, split the optical path into the camera, use different spectral filters over various op-

A model of the shuttle showing Getaway Special location in bay.

tical paths, and get composite or side-by-side photos simultaneously in several regions of the spectrum. If you want Earth-oriented photos, specify a flight in which the orbiter is primarily engaged in Earth survey work. If you want to look at the stars or the Sun, specify a flight or a portion of a flight in which the payload bay is looking in the direction you desire. You could then compare your photos with those taken from existing NOAA weather satellites or Landsat.

The weightlessness of orbital flight would also permit you to conduct some experiments that you could not do here on Earth. For example, you could run some experiments in alloying, which is mixing two or more dissimilar materials together. Because of the electric power requirements for obtaining high temperatures, you will probably be limited to experiments using low-temperature materials such as room-temperature amalgams. The mixture of mercury and silver used by a dentist to fill cavities is an example of a low-temperature alloy or amalgam. You might even be able to do some interesting experiments in new dental amalgams because mercury and silver don't mix very well. This is because the two materials have different densities and because mercury does not "wet" other materials. A dentist usually has to shake his amalgam pretty violently and then get it in place very quickly before it separates into mercury and silver again. In weightlessness, the problem of density differences are no longer a factor.

Photographing the behavior of liquids in weightlessness would be another interesting experiment providing you could design in the electric power required to run a camera light; the camera could be spring-wound. Some liquids such as mercury will not "wet" a surface; what will happen in weightlessness? Other liquids such as water or a detergent-water mixture "wet" very well. I have always wondered what would happen to a wetting mixture in weightlessness. Even in a gravity field, it forms a meniscus and tries to climb up the sides of a container. In weightlessness, would such a liquid try to wet the entire surface of its container, and eventually surround the container in a glob of liquid? Interesting!

You will note that the experiment suggestions thus far have involved very little in the way of on-board electric power. Batteries could eat up a very large percentage of your weight allowance, and they would have to remain charged for the two months prior to flight when you cannot get to your Getaway Special package. They are also a heat source in flight because they supply electric energy. . . and there is something called the Second Law of Thermodynamics that says you will *always* have waste left over. But, by using some brains, you could design your experiment to be run by a small Stirling engine driven by solar radiation. You can buy them off the shelf.

I have not suggested any biological experiments for one simple reason: the two-month pre-launch time period between your delivery of your package to NASA and the time it flies. Undoubtedly, there will be some biological experiments that can be designed to overcome this 60-day period of total neglect prior to the experiment. Maybe I just don't know enough about biological experiments. But it would seem to rule out most experiments involving live organisms of even the most primitive sort.

Now just don't take these experiment suggestions and run with them. I have cleverly built a hidden flaw into most of them. The Getaway Special is something totally new, and it is not the same sort of thing as an Earthbound experiment. You will have to do some research. You will have to do some very careful thinking. Most of all, you must strive for the "elegant" experiment that has simplicity as well as pizzazz. Most of the great experiments in science and technology have been "elegant" experiments done with simple equipment and getting right to the heart of the question.

Good luck! I envy you. You are among the first space industrial engineers!

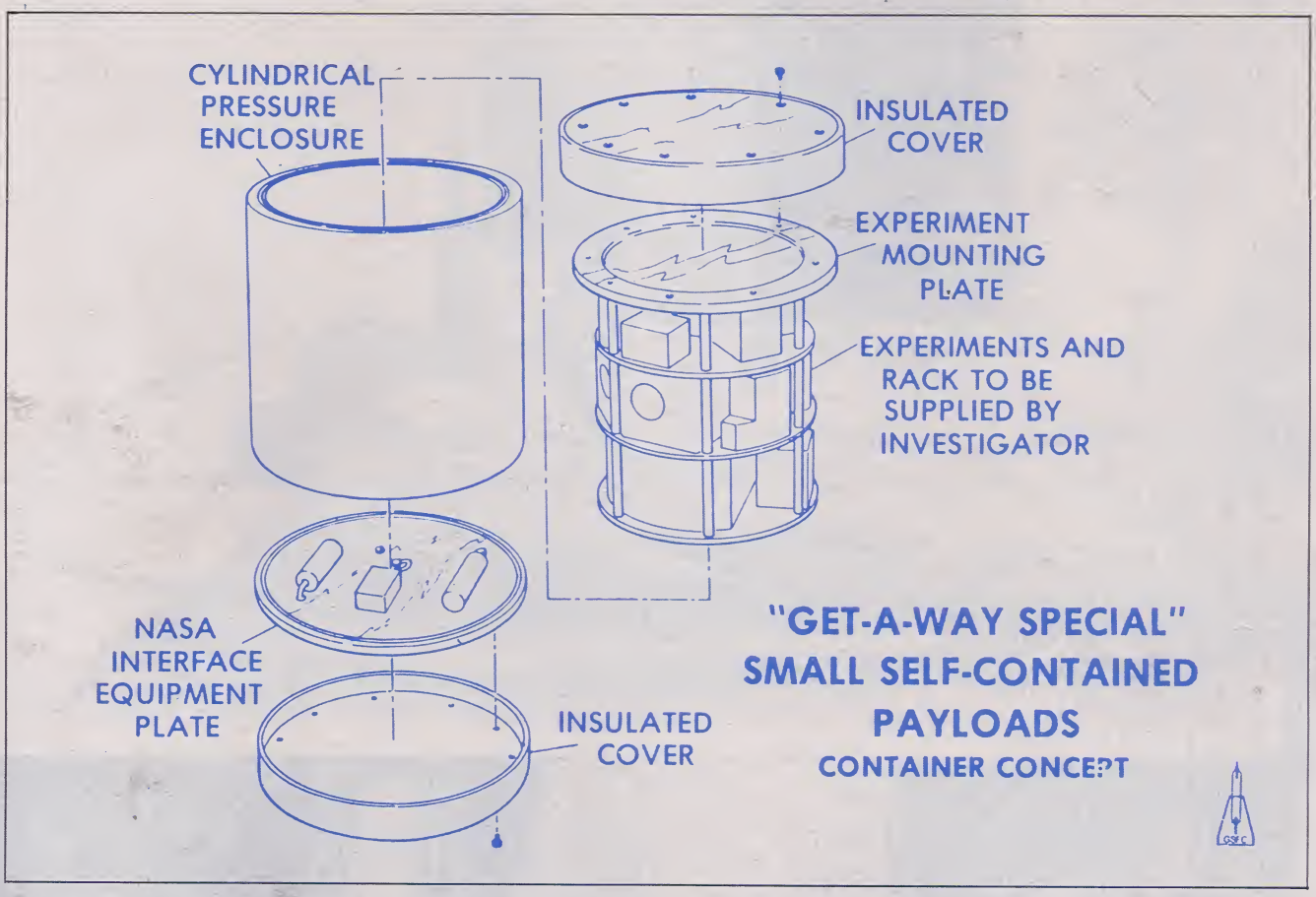
Design challenges: It's not as easy as it looks

PHOTO: NASA

Before charging ahead to enter your Getaway Special experiment proposal in FUTURE LIFE's contest, you really should get the NASA booklets and information detailing all the requirements, restraints, and environmental conditions to which the experiment will be subjected. Designing a space experiment is not easy. The primary reason for this is the fact that all of us have a distorted notion of the universe because we were born and grew up on a planetary surface with a thick, hot, oxidizing atmosphere and a gravity field present at all times. So many things we take for granted here just aren't so in most of the universe.

The biggest problem that will be faced by Getaway Special experimenters, according to Jim Barrowman of NASA Goddard Space Flight Center, is thermal control. Here on Earth, heat can be transferred by conduction, convection, and radiation. In space, heat transfer is mostly by radiation with some conduction possible into a larger body (such as the orbiter itself). However, heat can flow both ways out there. Your cannister can be insulated to take care of anticipated heat problems, but you must anticipate these problems. Once your package is up there, it's too late!

Heat can flow into your package from the orbiter, from other payload bay



Above: A schematic showing how NASA's Getaway Special container is being designed. Options such as windows in the container top and vents to admit the vacuum of space will cost extra, and the container may be modified for some experiments.
Left: Container with NASA official for scale.

sources, and from direct exposure to the solar output.

Heat can flow out of your package by conduction through its mounting flanges and into the orbiter structure, or it can be radiated away into space. . . provided the payload bay is not looking at the Sun at the time.

Any internal heat generated by your package is going to have to be accounted for. Internal heat can come from any number of sources. Mostly, it will come from the operations of electric devices such as motors, electronics, etc. Some may come from chemical sources. Or even from biological sources. You will have to think about this and perhaps even work with NASA engineers to insure the thermal stability and suitability of your package.

Internal power is going to be another Getaway Special design problem. You can pack only so much battery power into the weight and volume limits of the container. You should consider using as little internal electric power as possible, utilizing solar radiation to drive a Stirling engine or a photovoltaic array, or Peltier Effect from hot-cold junctions.

Perhaps the biggest problem to be faced is the fact that your experiment must be delivered to NASA at the Cape *two months* prior to the time it flies. You will not be able to see it, work with it, adjust it, or otherwise repair it for at least 60 days before its flight. NASA will put it in its cannister, bolt it into the orbiter payload bay, fly it, give it three on-off switch signals in flight, take it out of the orbiter upon its return, and give it back to you perhaps three to ten days after it flies. Your hardware is going to have to be super-reliable; it's going to sit around for two months, take a rough ride into space, and be required to work as planned. If you have batteries aboard, they are going to have to hold a charge for 60 days and then deliver their energy when called upon.

This one 60-day advanced delivery requirement rules out most obvious biological experiments. You will have to have a biological package that does not require feeding, disposal of biological wastes, replenishment of growing medium, replenishment of life-support materials, etcetera. This eliminates nearly all of the higher organisms and may even eliminate the use of most insects. If you are using protozoa, you had better have enough culture medium in there to keep them alive for two months. If you have a plant aboard, remember that it is *dark* inside that cannister and you will have to provide some light for photosynthesis. . . and batteries to run that light for two months!

These problems should not be viewed as roadblocks. Most scientists and engineers run up against restraints that are even worse in their everyday work. But they do mean that you are not going to be able to lash-up some sort of experiment, let NASA stuff it into a cannister, fly it into orbit, and expect it to work or provide data. It does mean that you are going to have to make exhaustive tests beforehand. Because if you blow it in orbit, it will be at least a couple of years before you can get back aboard another shuttle flight.

You don't have to have all the problems solved for your proposal. But there should be some indication that you have thought about potential problems.

All of which makes this perhaps the most exciting and realistic scientific contest ever run anywhere at any time! If it were easy, anybody could do it! —G.H.S.

PORTFOLIO

SYD MEAD

With his deft brush and keen sense of design, Syd Mead considers the future and makes it live on canvas.

Syd Mead's art is well-known to futuristic hardware fans. Most famous for his avant garde automobiles (two are pictured on the page opposite) his imagination is not limited to forms on four wheels. A recognizable hallmark of his designs and paintings is the organic flavor inherent in all his mechanical objects. "I have always been fascinated with organic/mechanical crossover in natural systems," he says. "Vehicles have their own organic organization. The human body and animals have a mechanical organization which is accomplished through bio-organic means. What attracts me is the trade-off between these two seemingly incompatible systems. The skeleton of the human body is elegantly mechanical. The amazing thing is that it is accomplished with organic chemistry. It's amazing that it works at all. If you had to construct a camera and the specifications were that it had to be 98 percent water, it would be an insurmountable technological feat. But of course, the eye is a gelatinous orb kept in shape by muscular tensions."

On the following pages, a portfolio of the organic/mechanical creations of Syd Mead, with his comments and explanations. *Sentinel,* a fabulous collection of Syd Mead's artwork, will be published later this year by Dragon's Dream, Ltd.

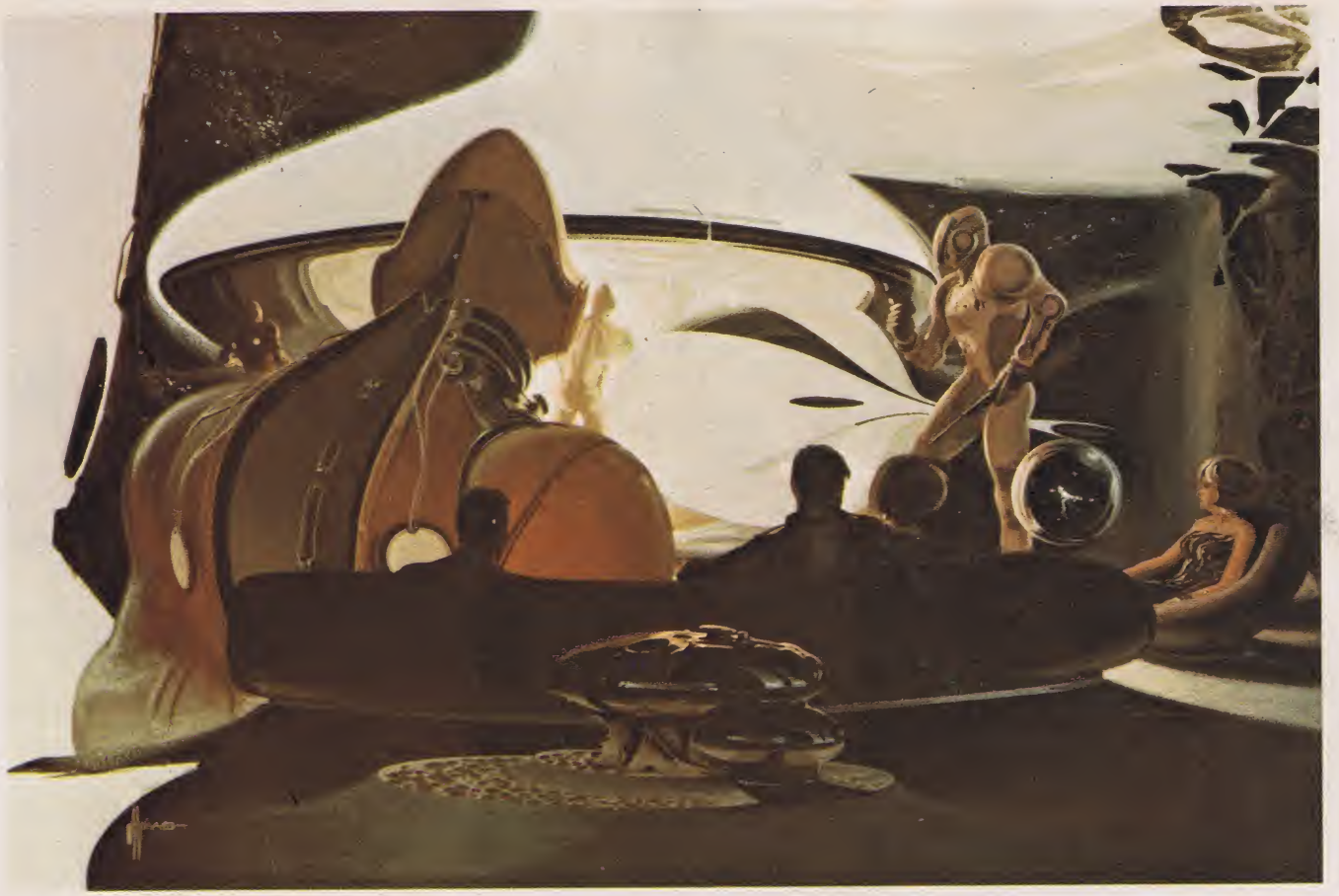
ALL ART: SYD MEAD

Top of page: A 1968 automobile design with a vacuum-formed plastic sheet enclosing the mechanical clearances. The sleek auto is still futuristic eleven years after it was designed.

Above: A working, full-scale model, built and exhibited by Ford in 1963.

Left: A vehicle that would thread its way through jungles and swamps. It is Mead's only private commission to date.

A vision that concerns the idea of high technology failing. "The disaster syndrome is always a very attractive subject, I suppose," Mead says. "This is a piece of some large transport device that has crashed. The operational parts have been salvaged, much as when airliners crash and people use bits and pieces of the plane to piece together a shelter for survival until they're rescued. Here, the anti-gravity coil is floating across a giant fungus field, hopefully to be rescued by a settlement across the chasm. They've borrowed bits of cloth and fabric to ward off the harsh rays of the Sun, and fortunately have been able to cobble together this control circuit and wire it into the power source of the crashed spaceship. So they're using this part of the wreck as a kind of lifeboat."



Above: A space station under construction as it orbits Earth. Mead: "It's over the coast of China. A delivery rocket has just brought more material and another rocket is entering the zero-g docking port in the center of the rotating circle."

Right: "I'm sure we will eventually construct biospheres in space. This is a pleasure world, docking after three years at an intergalactic interchange to exchange its inhabitants for a new batch of vacationers." (This is a preliminary sketch for a painting, of which a detail is shown on page 2 of this issue.)

Left: "A family watching a holographic space opera in their living room."

Below: "An example of my favorite pastime while waiting in airports: sketching aliens. The popularization of the alien has been to make it horrible, always threatening mankind in some strange and exotic way. This won't necessarily be true. Once commerce is established, we're going to meet some very strange phenomena, and we'll have to stand in the same lines together."

ALL ART SYD MEAD

Above: "At an intergalactic exchange point, some very large spacecraft are coming in for docking. These are several miles in height. This is a preliminary sketch, about 5"x 7". I have files of sketches like these; all things that I want to do finished paintings of someday."

Nova

(continued from page 53)

camera. If you can stay calm, you can figure out ways to get around it. *If* you can stay calm, that is."

Nova Vs. The World

John Angier shrugs his shoulders when asked about the possible difficulties involved in keeping *Nova* running smoothly. "We have constant disasters," he says matter-of-factly. "The Sun doesn't shine when you need it to or it rains. But those are the things that you take for granted in documentary filmmaking. There are some problems concerning subject matter from time to time, as well.

"When we did 'The Mind Machines,' for instance, a block of the scientific community decided that it didn't want us to do a show on artificial intelligence and began circulating anti-*Nova* letters to their colleagues. However, an even bigger faction wanted the show to be done. We managed to get everything we needed. The letters had no effect whatsoever.

"We've also had people try to discourage us from filming. Not in a physical way, of course, but by refusing us permission to go on location at certain places. Usually, though, we plan on that. We couldn't expect to film on some government installations, for instance, because of classified information and all that.

"Co-producing presents a few problems to us as well. We've had to scrap a show or two that were done as co-productions. We scrapped one done with the BBC on archeology. It wasn't shelved because it was controversial. It was simply too dry and too technical for an audience that wasn't actively involved in archeology. There have been some shows we've received that we've simply reshot because they weren't suitable for our audience. The ideal *Nova* should be able to reach just about everybody."

With these constant difficulties arising, why bother to keep the show going at all? Angier doesn't skip a beat. "Because there's nothing else like it," he states simply.

Two days after this interview, local union film editors and cinematographers added to Angier's headaches by going on strike, slowing production to a trickle and pushing *Nova*'s spring '79 offerings back into the fall. *Nova* headquarters remained characteristically optimistic about it all. "Think of it," said one series spokesperson cheerfully, "this will be the first time one of our new seasons starts at the same time as the network seasons!"

Out of Sight, Into Mind

"There's no experience quite like *Nova*," Veronica Young says nonchalantly. "Putting one of these shows together, you learn just as much about the subject at hand as your audience eventually does. During this 'Vision' production, I found out that there are nearly seven million people in the country who are classified as legally blind. Perhaps only three-fourths of a million of that group see absolutely nothing. The rest have some useful vision, whether it's light detection or shape detection or partial vision.

"This is the huge, twilight majority of them. I think that the public at large isn't aware of this. I wasn't aware of it. These people are not to be written off. There's an enormous amount that can be done to help them maximize what they've got. Low vision people are legally blind because that classification helps them get monetary benefits. It doesn't mean they can't function creatively. That's one myth I'm trying to attack.

"What I try to say in the show, along with the scientific facts, is that there is much more to the eye than seeing. We associate power with the eye. Look what happened to Oedipus. Look at his punishment. He wasn't killed for his crime, he was blinded. The *Nova* film touches on some of these things, beyond the reality of blindness, delving into the emotional investment of eyes.

"I really believe that most of us fear damaging our eyes. It's psychologically significant to all of us. When you look into the eye, you see right into the brain. The retina is a piece of brain tissue. The eye comes by the optic nerve and through the skull. It's brain extruding there. No wonder we all feel that the eyes are the window to the soul."

Veronica Young returns to her editing chores. Two months of researching have gone by. Three weeks of shooting. Three months of editing. This fall, her show will air coast to coast. Detective work well done.

Surrounded by progress reports of shows nearing completion and ideas for next season's series, John Angier reflects on the activities spread across WGBH's floors of offices. "I really don't know if I could say there is a successful formula for a good *Nova*. We somehow manage to cover everything. Computers. Space travel. Oil spills. It's hard to define the show. We like to tell a solid story, every week, dealing with science. But it's a story that has to interest, entertain and inform.

"I suppose some people get the impression that our subject matter is 'lofty.' Yet, *Nova* is one of the top-rated programs on PBS and we're still attracting new viewers. *Nova* is designed for a general audience, but I wouldn't go so far as to say that *everybody* should watch it. I will say that it's a show that relates to the world around you. If you are at all interested in your world, you will be interested in *Nova*."

"The show is educational," he adds as an afterthought, "and useful. . . and fun." In the midst of organized chaos, Angier begins to formulate plans for the 1979-1980 season. Projects. Proposals ad infinitum.

The detective work begins again.

Space colonies

(continued from page 45)

petitive things.

The interesting point is that, although the hardware we have to lift into space is assumed to cost something on the order of $1,100 per kilogram to make, then another $200 to $700 to put up to low orbit, and we are producing things that are worth only $18 per kilogram, even then we make a profit. The reason, of course, is that we are getting an enormous amount of leverage from the bootstrapping which goes on.

We can see how that leverage occurs if we assume the construction in space of a number of 10,000-megawatt satellite power stations. If we build enough satellites to produce enough power to supply all of California, for example, or all of the United Kingdom, there's quite a value associated with such scale. Naturally, the earnings picture turns around as well. We have profits rather than losses, even though we're still paying interest on all the previous investment. When that particular scenario takes off, the profits really go out of sight.

A detailed view of this same approach, done by Shettler, Vajk, and Engel, indicates that we will need to invest something on the order of an Apollo project, between thirty and sixty billion dollars, in today's dollars, to reach the point where we begin earning money. However, when you begin earning money, it's quite a lot. It gets up into five, ten, and more billions of dollars per year. The market, as far as we can see, if satellite power were to work out, is very big indeed. It's somewhere between 100 and 400 billion dollars per year, worldwide.

So, even though the investments involved are comparable to the Apollo project (for scale, that's about one-twentieth as much as we're going to have to be spending on electric generators of one kind or another over the next 25 years anyway), the question really is: Shouldn't we be spending a few percent of this money on a limitless source of energy which will remain just as good a thousand or a million years from now as it is right now?

We're looking at something which is a very exciting possibility. It is only a possibility; there's an enormous road of research and effort ahead of us. If, however, a time-scale is followed which was traced with great detail, it might see the first lift-off supporting this effort as early as 1985, and the first power station coming on-line by about 1991, with most of Earth's energy supply being picked up by satellite power plants constructed in space by the late years of this century or the early years of the next.

But very clearly, to realize the vision of the High Frontier, it's going to take people —all of us—and we need all the help we can get, so that we can see, hopefully within our lifetimes, the humanization of space. F

War in Space

(continued from page 24)

ploying directed energy weapons in space, the side with that defense would no longer have to fear the strategic weapons of the other, and could act with impunity. If the other side saw this happening, it might launch a pre-emptive attack while it still could—or it might try to destroy the space-based ABM system. Ending MAD may or may not be a good idea, but getting from here to there could be very dangerous.

If one nation began orbiting an ABM system, a rival power might put weapons in space to hit the ABM platforms in a crisis. And the country with the ABM system might defend its platforms with other weapons, maybe even a Space Force. Of such situations are arms races born.

The High Ground

For the past ten years, scientists and engineers have been discussing the idea of solar power satellites. These giant structures, orbiting 22,300 miles above the equator, would collect energy from the Sun, convert it to microwave energy, and beam it to receiving stations on Earth.

The microwave beam would be too diffuse to be an effective weapon. While the beam as a whole would carry a great deal of energy, it would be too weak at any given point to damage objects or people in the atmosphere or on Earth.

But the SPS would be a titanic concentration of energy at one point in space—gigawatts of available power. Even if its builders had no intention of turning it into a weapon, by mounting on it a laser or particle beam device, other nations might fear that the SPS would be used this way. They might tolerate the construction of an SPS only if it were under international management, or open to inspection. The situation is complicated further by proposals that lasers may be more efficient than microwaves for transmitting power to Earth.

The SPS, along with the space factory, is one of the keys to space industrialization. Those facilities would extend the human economy beyond Earth, and might allow us to escape the limits to growth by using extra-terrestrial resources of minerals and energy. But these installations also would be strategic targets, vital to Earthside economies. They would be vulnerable in wartime. They would have to be protected, by agreements, by threat of retaliation, or by weapons in space.

Space Power

An SPS system would be in one of the key strategic locations in space—geo-synchronous orbit. There a satellite hangs suspended over one point on the surface, with a view covering a third of the planet. In 1976, several equatorial nations formally claimed sovereignty over the portions of geosynchronous orbit above their territories. While they now lack the technological means to enforce those claims, this may be the first step toward the extension of national sovereignty into space.

There may be other key locations in space. Salkeld has suggested that an advanced nation could stir up the Van Allen radiation belts around Earth, preventing safe transit by enemy spacecraft. A nation which controlled the polar regions then would control access to space. Dandridge Cole proposed the "Panama theory," arguing that certain certain locations in space have unique strategic value, perhaps including the gravitational null points in the Earth-Moon system (like the L-5 location suggested for space colonies), the poles of the Moon (which might have frozen water), and some asteroids.

Early in the Space Age, there were suggestions that the Moon might be valuable as a launching base for strategic weapons. That now looks like a dubious proposition. But the Moon may be of great value as a source of minerals. Moon mining could lead to Moon colonies and lunar industries, and they in turn could support the construction of space colonies, like those visualized by Gerard O'Neill.

We like to think that the use of the Moon would be a cooperative international venture, for the benefit of all humankind. But nations may vie for colony sites, or fear the intentions of their rivals. Giant corporations, backed by their governments, might contend for rich lodes of ore on the Moon or among the asteroids. The military rivalry of nation states could be extended to the Moon, and beyond. During the 19th century, European nations went to the brink of war several times over their rival programs of colonization.

Can Space Be Kept Peaceful?

The Outer Space Treaty says that space is to be used for peaceful purposes. But treaties have not prevented the testing of anti-satellite devices. Some believe that laser and particle beam weapons would be allowed in space because the Outer Space Treaty forbids only nuclear weapons "and other kinds of weapons of mass destruction." A U.S.-Soviet treaty does ban space-based ABM systems. But the reach of weapons is being extended outward from Earth. If not limited, these weapons will threaten all man-made objects in space.

The U.S. and the USSR have begun to discuss anti-satellite arms control, so far without visible result. Space lawyer George Robinson argues that the Outer Space Treaty should be extended to deal with new threats to the peaceful uses of space. But technology does not wait for diplomats.

For years, nations have been negotiating about the Law of the Sea. The thorniest problem has been to work out an international regime for the seabed, which contains valuable mineral resources. The problem remains unresolved. In the United Nations Committee for the Peaceful Uses of Outer Space, nations also have failed to reach agreement on how to exploit the mineral resources of the Moon.

A Forward Look

Satellites are not just pieces of metal that no one cares about. They are integral parts of modern economic and military systems. War in space would not be just a spectacular show of fireworks, cheered by audiences on Earth. Its consequences would lead directly back to the planet. Space expert Philip Klass believes that any Soviet attempt to use its satellite killer would turn space into a battleground, and return the world to the perilous days of the late 1950s.

There will be a quantum jump in sensitivity when manned spacecraft begin to operate regularly in orbit. Each side may worry about what the other is doing with its shuttle orbiters. Is it inspecting the satellites of its adversary? Tampering with them? Quietly dumping laser satellites overboard to hide in orbit?

An attack on a manned spacecraft would inflame national passions. Not only does a U.S. shuttle orbiter cost about half a billion dollars; there would be human lives at stake. To avoid crises, the space powers might work out "rules of the road" in space, avoiding "incidents at sea" that might lead to war. But the task will become ever more complicated, because the U.S. and the USSR are no longer alone in space. The Chinese, the Japanese and the Western Europeans have satellites in orbit, and all have ambitious plans for the utilization of space. The West German company OTRAG is offering launch services to less developed nations. International politics is spreading beyond the atmosphere, with no universal policeman.

Air Force Colonel Earl Hansen argues that the future will see uniformed Space Forces providing security for all peaceful space ventures, as navies now protect merchantmen, tankers, and fishing fleets. The White House has announced that the U.S. is determined to preserve freedom of access to, and use of outer space, and that it would regard interference with U.S. spacecraft as an infringement on sovereign rights.

Maybe the diplomats will work out agreements to limit antisatellite arms, or to forbid the stationing of weapons in space. But history suggests that military forces will follow exploration, and will protect factories, power plants and colonies. And those forces may not only protect space habitats, but may eventually be used to suppress colonists' independence movements.

We may live to see navies in space, the captains of their "battleships" eyeing each other suspiciously as they pass in the void. Those fleets may expand outward into the solar system behind the explorers and the colonists, as long as humankind is divided into separate nations. But someday, in the ultimate irony, the finest and most expensive weapons the human mind can devise may prove helpless against the powers of an alien civilization, expanding from another star.

Timothy Leary

(continued from page 34)

simply a genetic device. Egg wisdom has developed this university to keep you adolescent as long as possible."

The cheering audience apparently agrees. Leary grins. "At this point I'm going to interrupt this broadcast from station WDNA to bring you a public service message for pedamorphosis.

"Young men and young women of America, I urge you, by all means possible and for as long as possible, *avoid terminal adulthood!*

"You don't have to give up anything, because the smart adolescent can get it all. You can make guerrilla raids into terminal adult camps, dress up the way terminal adults do and play their games for a while. But at all costs, resist terminal adulthood."

The pedamorphosis commercial is meant to expand and extend evolutionary options. "It is always the young of the species that evolves," Leary explains. "It works like this: a species is dealt out by egg wisdom to deal with a certain ecological situation and they get better and better at it. When we moved out of the water and onto the shoreline, the big thing in terrestrial territorial-turf situations was *size*. The dinosaur had it made. Every dinosaur was like a Mafia capo—nobody wanted to mess with him. But the dinosaur got so big he gave up mobility.

"Don't ever give up mobility," Leary warns. "Mobility is nobility. It's the key to intelligence increase and evolution. When all the old dinosaurs were sinking into the swamps, the young ones said, 'Hell no, we won't go!' and they turned into birds."

He emphasizes the importance of mobility and migration. "If you want to get smarter, move. If you want to increase your intelligence, move. For 4,000 years the smartest human beings on this planet have realized that you can stay and fight or you can move. Every time you move, you are forced to increase your binocular vision and activate new circuits in your brain.

"Young people have a need to differentiate themselves," Leary observes, "and the movement to space offers new avenues of ego identification.

"Young people don't know much about space colonization, but they're really 'spaced-out.' Just watch Saturday morning television for evidence. All this space in the media is a symptom. If you're an Evolutionary Agent operating on a planet of primates and you see all the young people into space—in the rock and roll industry, on television, at the movies, in their games—you regard that as a healthy sign. Evolutionary Agents comfort themselves with the knowledge that space consciousness is growing powerful."

As a self-proclaimed advertising agent for the L-5 Society "and those segments of NASA that want to go beyond the Teflon pan," Leary enthusiastically touts the virtues of high-orbit living.

"It should come as no surprise to you, my friends, that I'm talking about living in space because, as you know, I've always been an enemy of gravity. You've heard me say many times, I'm sure, that gravity is a drag, gravity sucks."

The movement to space, Leary asserts, is a natural evolutionary development. "Can anyone doubt the trajectory of egg wisdom? From the water up to the shoreline, from four feet up on two feet, flying first with petrofuels and then with rocket fuels out into space. The unbroken trajectory is what egg wisdom wants. She wants us to move faster, fly higher, link up in better communications and better love relations, so we can keep this thing going."

Space migration has prehistorical precedent, as he illustrates. "I'm going to take you back to the time when we were all amoebas and all we did was just hang around floating and sucking. The great thing about being an amoeba is you have no sexual problems. You don't have to worry about a date on Saturday night. If you want company, you just make like yourself and split.

"Anyway, the amoebas are so successful that soon you have overpopulation and pollution. The next thing you have is a youth revolt. It always happens this way."

He does a stern impression of a worried amoeboid political leader. "Comrade amoebas, you are warned. Some of your children have been seen hanging around shallow pools ingesting a non-socialist drug known as calcium. The AMA—that's Amoeba Medical Association—has conclusively proved that calcium is dangerous. It causes mutations. It causes head-tail syndromes. You wouldn't want your young amoebas to swim away from home never to be seen again, would you? Amoeba theologians have said calcium is a sinful thing. They say that if god had intended for amoebas to grow bones, she wouldn't have made calcium illegal."

Several millenia later, shoreline oxygen sniffing was treated in much the same way. " 'Whaddaya mean you want to leave the swamp?' the old fish said to the young ones. 'That's a cop-out. Why don't you stay and solve the problems here before you go crawling off into that hostile terrestrial environment?'

"Now we're facing the move into space and there are some 20th century alarmists using those same old arguments.

"The reason we're going into space is because it's the only way we're going to avoid socialism and the police state. Genetic intelligence wants diversity, but we simply cannot have cultural lifestyle experiments on a shrinking planet with shrinking resources. The only way we're going to have social experimentation with new styles of living is going to be in worlds we create ourselves.

"So when you think of space colonization, please do not think of *Star Wars* and *2001* and cowboys and Indians in the cosmos. Think of new mini-worlds, high orbital mini-Earths 30 miles long with selectomatic climate and populated by self-selection—those who want to live that way will go that way, just the way it happened when the Pilgrims came over.

"The biggest political danger to watch out for now is space being taken over by the military," Leary warns. "They're not just stealing oil wells, they're stealing the solar system from you!"

Leary notes that not everyone will leave the planet. "In any discussion about the future, if you want to make any sense, you simply must use the concept of caste. We are divided into many, many human castes and new species are evolving even now. So you simply can't generalize—every caste is going to evolve in its own way.

"Everyone's going to get exactly the world they want," he predicts. "If they want to live down here on freeways, they can do that. They can live in Uganda, they can live in New York. A lot of people will continue to live in cities like enormous anthills and watch television. And added to their insectoid consumerism, in addition to new forms of video, there will be a tremendous increase in hedonic rewards. They'll all have waterbeds and aphrodisiac drugs and they'll be living in insect cities happy as clams.

"But other castes will be evolving, moving out, changing directions. . .

"I gave this same interview to FUTURE LIFE in the slightly pre-Cambrian days," he explains patiently, "and I pointed out then as I'm pointing out now: some of our finny friends are not going to leave the water. They're going to stay underwater and develop into 21st century sharks and dolphins and filet of sole. Some will climb out to the shoreline and remain amphibians. Those that move out of the water will evolve into the entire range of terrestrial plants and all the animal kingdoms and species.

"When the human race moves out into space, there are going to be as many new species as there are land plants and animals."

The movement to space is an integral part of Timothy Leary's S.M.I².L.E. formula for the future. "You have to have space migration and intelligence increase before you can really have life extension," he points out. "Otherwise you end up with too many people on the planet and too dumb to know what to do about it."

Issues that many people consider the burning problems of our day—pollution, overpopulation, etc.—don't bother this Evolutionary Agent in the least. "There are no problems," he states. "You can have your doomsday scenario, but allow me to differ. Everything is going according to plan. Overpopulation and pollution are signs of a successful species. It doesn't mean stop and go back. It means it's time to go forward, get moving again.

"Mutate."

Future Crime

Does anyone recall that back in the 1930s F.D.R. set up a blue ribbon panel of science advisors and asked them to report on the most likely major scientific developments to come in the next 25 years? Their finished report made no mention of rocketry, computers or atomic energy — enough to make any prophet leery.

Now, all three items were capable of benefitting the world greatly during those next 25 years. All three items were also, of course, subject to abuse. And all three items were, indeed, abused. Yet, in the longer run, they have benefitted mankind.

I have reviewed the preceding essays in this series, and I've seen an impressive list of bright possibilities, barring major catastrophes and blunders. A stable population, sexual equality, longer life and increased leisure seem desirable, especially when accompanied by clean alternative energy sources (say, fusion plants and power satellites), with an increased shifting of tedious chores to computerized servants.

Many beneficial things could come of this projected leisure. Handcrafted items, for instance, would be increasingly desirable in a world of mass production, thus providing a fine outlet for the manually creative. With less pressure to get places in a hurry (so much business being transactable from the home with increased communications potential), we might see a revolution in travel, such as a return of the clean, leisurely dirigible. We might also witness an upswing in continuing education—people picking up the liberal arts courses they hadn't had time for when learning more technical skills.

I could go on and turn this entire column into such a list. But, as a student of history, something else occurs to me. Anything exploitable will be exploited.

I am thinking of the future of crime.

If I were, at present, a successful criminal and my son expressed a desire to follow in my footsteps, I would send him off to get an education in engineering and computer science. Almost everyone I know with such a background has stories of people figuring ways to beat the system using those skills; of crediting accounts improperly, stealing time, crashing programs, altering grades by piercing the school's records system, or placing free phone calls with "black box"-type gimmicks. I've heard amazing electronic crime stories from bankers which I will not detail here.

And, of course, programs themselves can be stolen, systems penetrated and data stolen, et cet, et cet. The potential for the criminal exploitation of a highly computerized world is immense—and to quote John Gall, "When a fail-safe system fails, it fails by failing to fail-safe." This does not seem so far-fetched as it might when someone is actively seeking to circumvent the system's safeguards.

I've a feeling that with increased security, crimes against the individual may well fall off—and this, of course, would be a very good thing. But when any system or organization gets big and depersonalized, people tend to feel a lot less guilty about ripping *it* off. It is the "white collar crime" syndrome, even if we won't be wearing white collars then. There is a natural human tendency—which I find laudable, a mark of the primate ingenuity which has brought us as far as we have come—to attempt, often successfully, to find ways to beat any system, whether or not one actually intends to do it. And then...

I (who have had a book go out of print prematurely because of an incorrect computer instruction) can see nonviolent hijackings managed by the intentional misrouting of goods, the instructions later doctored. I can see phony orders, phony receipts, phony accounts. I can see entire corporations existing only on printouts. Several books have already been written on these subjects.

Enough. In a number of instances today, people who have done such things, rather than being prosecuted, have been hired as troubleshooters by their victims. Hopefully, they make it more difficult for the next guy.

In this column, Ben Bova pointed out the dangers of a hostage power satellite. Consider fusion plants down here on the surface of Earth. According to my Los Alamos informant, these plants would likely be the size of a small city and there would not have to be an enormous number of them. What does that suggest? Strategically, if we were relying on them exclusively for power and if even *one* of them were put out of commission, it would make the New York Blackout look like very small beer. Who would do such a thing?

The point I am aiming at is that for every addition to the complexity of society some

Zelazny

Roger Zelazny has kept a full-time eye on the future since 1969, when he left his job as a claims policy specialist to write such award-winning science fiction works as Lord of Light *and* The Doors of His Face, The Lamps of His Mouth. *To date he has published approximately 85 short stories and articles and more than 20 books. His most recent novel,* The Courts of Chaos, *is the final book in his Amber series. Zelazny's talents have not gone unrecognized: he has to his credit three Hugo awards, three Nebula awards, and he was the Guest of Honor at the 1974 World Science Fiction Convention in Washington, D.C. His works have been translated into most of the world's major languages, including French, Spanish, German, Hebrew and Japanese. His 1969 novel,* Damnation Alley, *was filmed by 20th Century-Fox under the direction of Jack Smight. The movie was released in October of 1977 and, according to Zelazny, "bears very little resemblance to the book." He now lives in Santa Fe, New Mexico.*

If I were at present a successful criminal and my son expressed a desire to follow in my footsteps, I would send him off to get an education in engineering and computer science. . . The potential for criminal exploitation of a highly computerized world is immense. . .

new means of criminal exploitation will suggest itself to someone. I do not see any way around this, because it is in the nature of the human animal to try to solve problems. Any new situation causes someone to look for an angle. Science fiction writers do it all the time—in pleasant, socially acceptable ways, I hasten to add.

Will the future see people living longer? I think so. Will we wipe out V.D. as we have smallpox—once the hangups surrounding such a public health project have been outgrown—thus, finally taking all the danger out of being close? I think so. Will our current lifestyle be the subject of a nostalgia kick one day? Probably. Will we mine the asteroids, have labs in space, a base on the Moon and well-populated O'Neill colonies? It seems likely. Will we wipe out crime? I doubt it. Is this a bad thing? Again, I doubt it. Society has always absorbed its losses from theft and continued on.

If there is a decline in violent crimes against people I think we will be coming out ahead of the game. The others, the sophisticated crimes coming from more sophisticated criminals in a more sophisticated society, should, when detected, serve to strengthen the systems they offend against —and this, too, is a kind of growth.

If the human race ever loses the tendency to scheme against the system, we will be in bad shape. It is another aspect of this same quality that helps us to keep the system itself in line and, if it becomes unbearable, to find ways of destroying it. It is a part of the human survival mechanism, and we know of no way to selectively stifle it.

And when most of the bugs in new systems have been stepped on, of course the very next development to come along will provide new opportunities for exploitation. It will be a fascinating time in which to be a cop. Security systems of all sorts will be good investments.

Can you imagine the following *Adam-12* episode?

A sinister-appearing individual sits before a computer terminal. He checks some papers and encodes instructions.

CUT TO: Two cops sitting in a similar room elsewhere, drinking coffee and talking about the girls/guys on *O'Neill II*. A buzzer sounds, a telltale light appears on their console. They encode a "tail" for the illegal program, following, recording and canceling it, while tracing its origin.

A number flashes on the CRT. They dial it and turn it over to the arrest program.

CUT TO: Sinister-looking person answering his/her phone.

"You are under arrest. These are your rights. . ." says the recording. "If you attempt to flee custody, your credit account will be canceled. We are now shutting down your terminal. Will you report to your local Precinct at 9:30 tomorrow morning?"

"Could you make it 10:30? I have a dental implant appointment then."

"Surely."

"Thank you."

Click.

CUT TO: The cops, who log it and discuss the latest weather-control foul-up. Wouldn't it be something if some vandal had gotten to the Weather Exchange Teleoperator (WET) and was about to threaten the city with a storm during the tickertape parade for the astronauts returning from Titan? Nonsense. Nonsense? Better run it through and see if it could be done. . .

Click.

The future, as I see it, holds many such "clicks."

As with Roosevelt's think tank, though, there must be a lot that we are missing/have missed, both in science fiction and among professional futurologists. There is the wondrous, serendipitous shaping of the future by the billions of little decisions Fred Pohl referred to in this column. Who knows what inspired future criminal is being shaped by them at this very moment? And in what strange fashion?

And then there are always the big unguessable imponderables, such as the possibility of our encountering or communicating with an alien race. Now, there may be criminally exploitable possibilities there that would make our most satisfying conglomerate-shuffling look like petty shoplifting. We may have a lot to learn from them, but then we may have a lot to teach them, too.

In the abstract—in the future, in the past —notions such as these can always be treated humorously. But when the future comes it will of course be the present, and it will be prudent if you recall that every new thing under the Sun provides an opening for an abuse as old as society, at least for a little while. . . and there will always be another.

Keep your hands on your credit cards, or whatever they're using. And never play cards with a computer named DOC.

ART: JOSE CRUZ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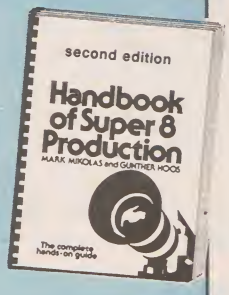

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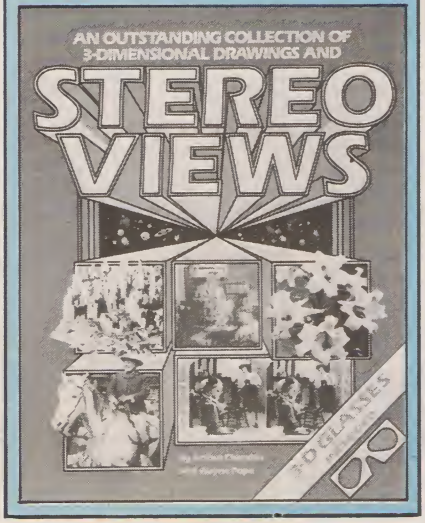

next issue

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ALIEN

If Alfred Hitchcock made a suspense-thriller in the year 2001, the result might well resemble *Alien*. Touted as the most horrific excursion into science fiction in years, the movie takes the old concept of cat and mouse and tosses it into deep space. FUTURE LIFE goes behind-the-scenes for a look at the suspense both on and off camera on the larger-than-life *Alien* movie set.

PHOTO MUSEUM OF HOLOGRAPHY

HOLOGRAPHY: THE WHOLE MESSAGE

According to an old axiom, one picture is worth a thousand words. How, then, do you put a price on a three-dimensional hologram — an astounding image worth at least a thousand pictures? FUTURE LIFE takes a look at the 3-D realm of holography; a science fiction turned science fact world where nothing is as it seems. Offering a state of the art review, "The Whole Message" will introduce you to holographic art, medicine and... movies!

PHOTO: © VIACOM, FROM "THE OUTER LIMITS"

COMMUNICATING WITH EXTRATERRESTRIALS

Fifty years ago, Flash Gordon and Buck Rogers struck up friendships with alien beings of every shape and size. Today, the U.S. Government is attempting to duplicate those fictitious feats with a series of projects designed to seek out and communicate with alien lifeforms. In our next issue, John Billingham, PhD, Chief of the Extraterrestrial Biology Division at the NASA/Ames Research Center, reveals the details of Project Cyclops, SETI, Project Ozma, UFO research and the tracking of radio signals from space.

HARRISON SCHMITT'S NEW SPACE PROGRAM

The last astronaut to leave his footprints on the surface of the Moon, Harrison Schmitt is a Senator these days. Not your average bureaucrat by any means, Schmitt is still kicking up a lot of dust by proposing an ambitious United States space program that will lead American citizens into space dwelling habitats, bases on the Moon and cities on Mars... all within the next 30 years! Schmitt explains how in this exclusive interview.

PLUS:

Ian Watson investigates the role of religion in the future... The designer of TV's atomic powered *Supertrain* relives the nuts and bolts birth of the streamlined wonder... Media-minded corporate executives present the case for the videodisc: the next revolutionary development in video software... Carolyn Henson finds more *Alternate Space*... A list of the hottest spots to visit for a very scientific summer vacation... A close-up, full-color look at Jupiter and her moons as viewed by the Voyager spacecraft... movie previews, book reviews, Databank news, newsounds and hardware.

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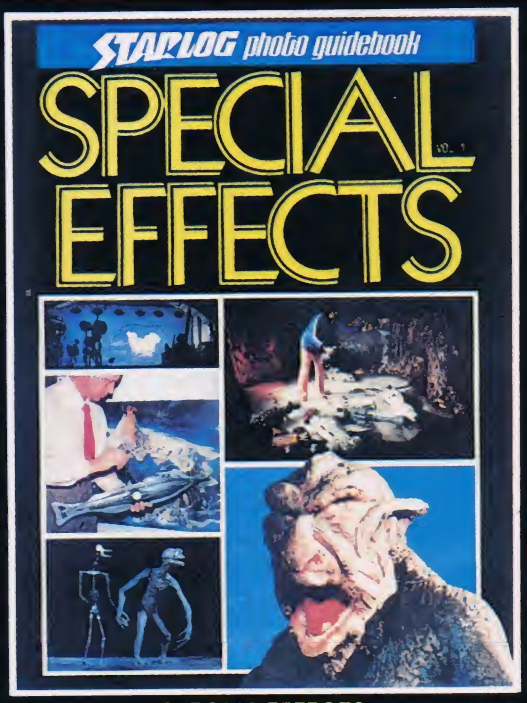

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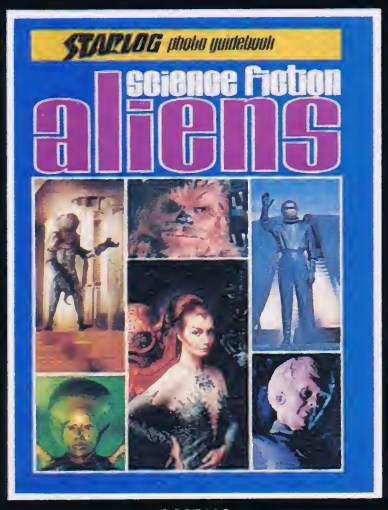

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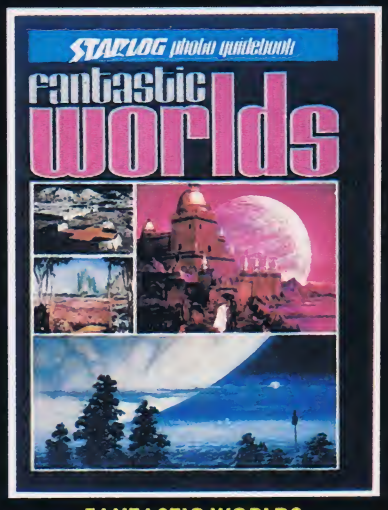

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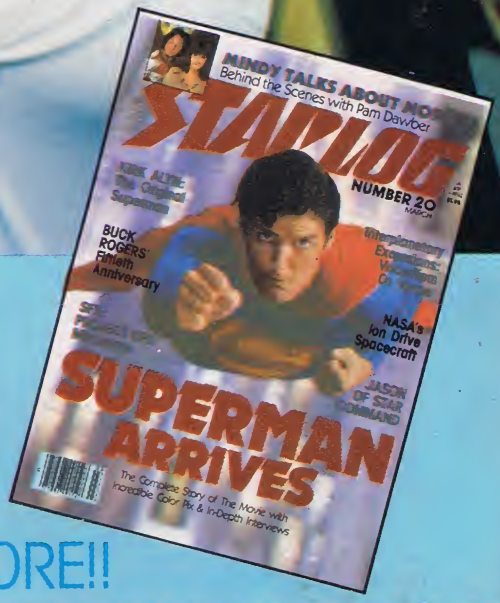

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